TIME-GEOGRAPHICAL AUTHORITY CONSTRAINT AND ALLOCATION OF TIME BETWEEN WORKPLACE AND HOME

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This Master's Thesis examines the allocation of individuals' working time between paid and unpaid work, and thus between workplace and home in eight European countries. Time-geographical theory, where an individual's activities are affected by constraints to activity, forms the theoretical framework. Classification of countries into the Nordic, Continental, British, and Peripheral welfare state regimes represents the authority constraint in time geography. An individuals' decision to retire is taken as an event in lifetime allocation of working time between home and the workplace.

A common concern in European economies over the demographic ageing of the population and the decreasing labour force participation of the ageing has prompted research aimed at a better understanding of retirement behaviour. In this work, data from national time use surveys are used in the documentation of time use in Austria, Belgium, Denmark, Finland, Germany, the Netherlands, Portugal, and the United Kingdom. An economic value is assigned to the time spent in household work, and financial incentive calculations for the decision to retire are performed.

There are differences in time use with respect to employment status, gender, and country. The non-employed spend more time at home and supply more household work than the employed. Women supply more household work than men do, regardless of employment status, but the allocation is more equal among the non-employed. Respectively, men supply more paid work than women do. Thus the female share of total work is close to 0.5 in most countries. The results from the financial incentive calculations for the decision to retire indicate that accounting for the value of household work yields stronger incentives to retire, and that household work encourages early retirement in all of the countries included in the study.

The time use patterns do not seem to follow the welfare regime typology very closely. Thus the time-geographical authority constraints in individual countries seem to work fairly independently of each other despite the ongoing convergence in social and economic factors in the European welfare states. However, measures of dissimilarity between pairs of countries do suggest some grouping with respect to location within the core or the periphery of Europe.

Linking descriptive analysis of time use and incentive calculations inclusive of the value of household work to the time-geographical framework illustrates the applicability of time-geographical concepts and methodology in comparative economic geography. This study contributes to an international research project *Ageing, Health, and Retirement in Europe*, and has been carried out at the *Research Institute of the Finnish Economy* where the author has been employed as a research assistant during the course of the work.

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1. OBJECTIVES, BACKGROUND, AND STRUCTURE OF THE STUDY

The objective of this work is to examine the allocation of individuals' working time between paid and unpaid work, and thus between workplace and home in eight European countries. The use of time in paid and in household work is documented using time use diary data. Time-geographical theory formulated by *Torsten Hägerstrand*, where an individual's activities are affected by constraints to activity, forms the theoretical framework. Classification of countries into welfare state regimes, originally introduced in sociology by *Gøsta Esping-Andersen* represents the authority constraint in time geography. An individual's decision to retire is taken as an event in lifetime allocation of working time between home and the workplace. Data from national time use surveys are used in the documentation of use and allocation of time.

In this work, I examine the effect of the authority constraint on the retirement decision by assigning an economic value to time spent in household work, and by performing incentive calculations for the decision to retire. Economic theories of allocation of time and household production connect the descriptive analysis of time use to the retirement incentives, while the welfare regime typology serves as a tool in explaining the differences and similarities between the countries. Figure 1 illustrates the synthesis of time geographical, economic and sociological viewpoints. The main research questions are if the authority constraints produce different time use patterns in different countries, and if the effects of accounting for household work on retirement incentive calculations differ accordingly. Expected findings include substantial differences in the absolute amounts and in the gender allocation of paid and household work across countries and regimes and thus in the effect of household work on the financial incentive to retire.

I have documented the time use in household work in Austria, Belgium, Denmark, Finland, Germany, the Netherlands, Portugal, and the United Kingdom. The work has been carried out at the *Research Institute of the Finnish Economy* (ETLA), and is part of ETLA's contribution to an international research program, which the *European Network of Economic Policy Research Institutes* is conducting with *Centre for European Policy Studies* in Belgium as the co-ordinator.

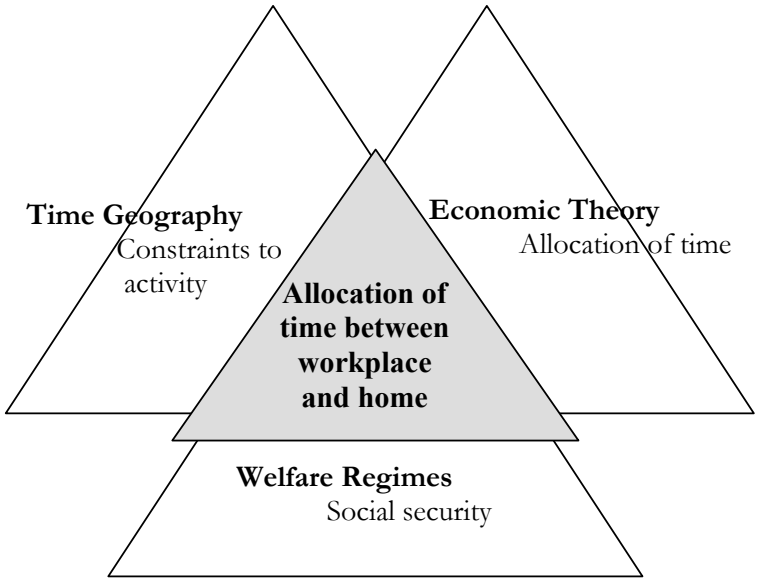

Figure 1. Theoretical framework of the study.

The program is titled *Ageing, Health, and Retirement in Europe* (AGIR), and its objectives include documenting and analysing the health of the ageing population and the decision-making by the aged with respect to retirement (ENEPRI 2002). I am working as a research assistant in the labour market research unit at ETLA, where the analysis of time use and the incentive calculations have been conducted with *Dr. Hannu Piekkola*. The theoretical approach and the methods applied in the AGIR project are based on the economic theory, and my thesis is therefore an independent work looking at the same issues from the viewpoint of geography.

One of the biggest concerns in most European economies is the ageing of the population and the expected increases in public expenditures on social security and pension systems. At the same time, the labour force participation of the ageing is decreasing. According to the European Commission, less than half of men aged 55 to 64 are still in the labour force in Italy, France, the Netherlands, and Finland, for example (European Commission 1998: 1). This reinforces the increase in the old-age dependency ratio, the number of people over 65 per a hundred non-elderly adults, which is already climbing due to the population ageing. Financing the pension benefits

and providing the services the increasing elderly population needs will become all the more challenging with diminishing tax revenue from a decreasing working population.

Raising the retirement age is one possible measure to be taken, and a pension system design that encourages people to keep working has for long been the objective of social planners and politicians. However, the observed ages of withdrawal from the labour force are substantially lower than the retirement ages. Further, determining the actual withdrawal age is not straightforward. The difficulty lies in the labour market behaviour of those below the retirement age who may show up in statistics as unemployed when they have effectively retired on the one hand, and of those above the retirement age who may have retired from their principal career but may be engaged in informal or secondary work on the other (OECD 2002a: 7). Table 1 shows estimates of the average ages of withdrawal from the labour force (OECD 2002a: 31). The figures have been produced with a dynamic estimation model, which utilizes a time-series of labour force participation rate data. In most of the countries presented, the official retirement age is 65. With few exceptions, the average ages of withdrawal are well below 65, even below 60 in some countries. It is thus evident that a better understanding of the incentives and behaviour regarding retirement is vital in developing pension systems that better meet the needs of economies and the individuals constituting them.

Table 1. Average ages of withdrawal from the labour force (OECD 2002a).

	Men	Women
Belgium*	59.0	58.9
Denmark	62.4	61.5
Finland	59.8	60.0
France	59.3	58.4
Germany **	60.5	59.8
Italy	59.3	58.4
Netherlands **	61.6	60.1
Norway	64.2	64.7
Portugal	65.3	66.5
Spain	61.1	61.1
Sweden	63.3	61.8
United Kingdom	62.0	61.2
United States	65.1	64.2

* 1971-1976
** 1993-1998

The next chapter will introduce the framework of time geography and its essential concepts. An overview of time-geographical research follows with a few words relating the work at hand to this tradition. The economic theory of allocation of time and household production is the point of departure for the financial incentive calculations with respect to the decision to retire. The theory is described in the third chapter, where also a review of previous time use research is given with some discussion on the methods of collecting time use data. Moreover, some trends in the use of time in work and in household work are presented in this chapter. The classification of welfare states into regimes according to political, economic, and cultural characteristics is presented in chapter four. Description of the data and the methods applied follow in chapter five, and chapter six presents the results from the documentation of time use, incentive calculations, and the examination of the applicability of the welfare regime typology to this kind of study. A discussion of the results and the contribution of this work to the AGIR project and its objectives, as well as time-geographical and time use research more generally conclude the thesis.

2. THEORETICAL FRAMEWORK

2.1. Time geography

Torsten Hägerstrand and his colleagues at the University of Lund developed and conceptualized time geography in the 1960s and 1970s. Time geography emphasizes the inseparable connection between the dimension of space and time, and examines human activity in the environment defined by these dimensions (Pred 1977: 207). The interaction of humans with other individuals and the environment is essential to time geography, and it has been viewed as a response to the specialized and fragmented approach to the conditions and outcomes of human activity in other disciplines (Pred 1977: 210). Since every object of research exists in place and in time, Hägerstrand calls for a synthesis of these dimensions. The aim of time-geography is thus "to try to turn human geography into a study of the conditions of life in a regional setting" (Hägerstrand 1978: 122).

Time-geographical approach combines the elements spatial and temporal analyses. Temporal analysis examines the duration and allocation of activities in time, while spatial analysis studies the use of land or space, determined by activities. In the time-geographic framework, both of these views are present, and the activities of individuals can be visualized as paths or *trajectories* in a three-dimensional *space-time*, and can be analyzed as dynamic processes (Lenntorp 1978: 162–163). Figure 2 gives an example of a daily space-time trajectory. Space is presented in two dimensions, although the physical characteristics of the landscape, such as the differences in altitude, can be accounted for when the movements of individuals in space and time are graphed as they affect the time it takes to move between places in space.

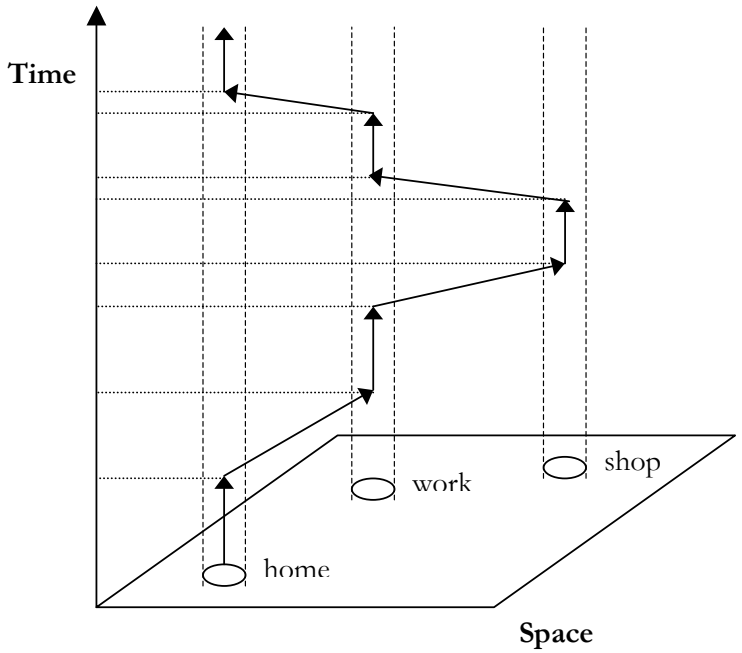

Figure 2. Activity trajectory in space-time shows that every event is defined both in space and in time.

2.2. Constraints to activity

Hägerstrand developed the central concepts of time-geography, at the core of which are *the constraints to activity*. They shape the trajectories in space-time due to the physical nature of these dimensions (Parkes and Thrift 1980: 22). The constraints are formulated based on basic *conditions of existence* that always hold for all entities, and are outlined here based on Hägerstrand (1977: 12):

1) All entities, living and non-living, are indivisible
2) All entities, living and non-living, have limited life-spans
3) All entities have limited abilities, and can only engage in one activity at a time
4) Every task has a duration
5) Movement between points in space consumes time
5) Space has a limited packing capacity
6) Terrestrial space has an outer limit
7) Every event is rooted in past events

Any activity can only take place when all of these conditions are met, with the exception of the possibility of simultaneous activities. The condition of indivisibility holds in these cases, however, and we can only engage in simultaneous activities if they take place in the same place and do not require the same skills or equipment. Hägerstrand translates these conditions into three constraints. First, we are all restricted in our choice of activities by *the capability constraint*. Physical restrictions, such as the need for sleep and nutrition at certain intervals and for a certain time, force us to devote a part of our time to these activities. Conditions of existence 1) – 3) have a strong influence in setting this constraint. The capability constraint can also be technological in nature: the quality and quantity of tools and equipment, or the mode of transportation we have access to, affect what we can do and where.

Second, there is *the coupling constraint*, which expresses where, when, and for how long we have to commit to a certain place or to the company of other individuals. In order to perform activities we may need the assistance and participation of other people, or the use of a certain piece of equipment located at a certain place is necessary. Furthermore, some activities determined by other constraints can only be performed in certain locations: Physiological needs require us to spend considerably long periods of time at home or in a home-like environment. Similarly, having family life and meaningful relationships generally calls for time spent at home together. All individuals or entities, whose trajectories cross in situations where the coupling constraint works, are subject to all of the conditions above.

Third, the rules and regulations of the society provide *the authority constraint* for example by determining the hours of work we are required to supply, or by regulating the opening hours of services. Further, the outcomes of the political, cultural, and religious traditions in a society shape the authority constraint by setting the limits of social acceptability on the one hand, and by directing individuals' preferences and desires on the other. The conditions of existence also apply to entities other than human, so the society and its organizations abide to them as well.

2.3 Chronogeography

D.N. Parkes and N.J. Thrift have worked extensively on the basis of time-geography, and provide additional viewpoints and applications to incorporating time in human geography. In their book *Times, Spaces, and Places: A Chronogeographic Perspective* (1980) they elaborate on this extended view on the relationship between space and time. They propose the use of the word *chronogeography* instead of time geography to illustrate the multitude of forms time and space can take (Parkes and Thrift 1980: 9).

Both space and time take broader meanings than the physical location expressed with co-ordinates and the clock or calendar time. In addition to these locational elements of space and time, there are experiental elements to both dimensions. *Experiental space* is defined through individual and unique perception of the social and physical environment. A mental map would be an illustration of the experiental space around an individual. *Experiental time* represents the notion of individual sense of time, not regarding the time of engaging in or duration of activities and events, but the appropriateness or the acceptability of an activity with respect to time, for example (Parkes and Thrift 1980: 33). This "mental clock" embodies the experiental element of time and accompanies the mental map in the extension of the physical notion of time and space.

In order to answer the fundamental question of what time is, Parkes and Thrift (1980: 36) cite Lynch (1972), who has said that time "is a mental device to give order to events, by identifying them as co-existing or successive". To further illustrate the elements of time beyond the time expressed by the arms of a clock, Parkes and Thrift (1980: xii) introduce the idea of *paratime* common to phenomenological, structural, and biological study of time as component of being. They distinguish between three different categories of time: *Universe time* is the time measured by clocks and calendars, and fully meets the eight conditions presented by Hägerstrand, and corresponds to the locational time presented in the previous section (Parkes and Thrift 1980: 36). The two other categories, which form the paratimes, are *life times* and *social times*, which represent the experiental element of time (Parkes and Thrift 1980: 37). Life time includes the *biological* and *psychological times*, which provide us with a sense of course of events and activities as well as our "sense of time". Life time is associated with the capability constraint in time

geography in the sense that our existence as biological and psychological entities depends on being subject to this constraint. Social time represents the collective awareness of the duration, frequency, and the sequence of activities with relevance in the community. I find social time expressing itself in the authority constraint.

Parkes and Thrift call life times and social times paratimes to distinguish them from the universe, or clock, time (1980: 37). Parallel to paratime is *paraspace*, which is determined by allowing for the space dimension to be defined in economic or social terms, for example, in addition to having the three dimensions of territorial or locational space (Parkes and Thrift 1980: 3). The same locational space may take different meanings as a paraspace to individuals of different social or cultural groups. Being employed or non-employed gives shape to the paraspace in which one operates, other potential determinants being age, gender, and physical condition.

2.4 Structuralistic view of the society

Parkes and Thrift view the society as a structure of levels that interact and through which information flows. This is comparable to the structuralistic view of societies and human geography applying structuralistic methodology. Within the structuralistic research tradition, a three-level model of the society has been adopted. The following description is based on Häkli (1999: 96–105). First, the functions of a society and its geographical organization form *the superstructure*, which we observe as the social, political, cultural and regional order of the society. The level below the superstructure is *the infrastructure*, which is the outcome of the active human processes taking place in the society. The infrastructure provides the researcher with a starting point in the study of the superstructure and the functioning of the entire society. The researcher uses the infrastructural processes and theoretical models of them to explain the superstructure. *Deep structures*, the underlying, often subconscious and intangible, characteristics of the individual and collective minds form the third and lowest level. The right hand side of Figure 3 presents the structuralistic model of the society and the associated activities in the society.

Parkes and Thrift's (1978: 119–120) model has four societal levels, the highest of which is *the superstructural level*. It can be viewed as *paraspace-paratime*, where the space dimension of the chronogeographic framework includes the political, economic, and societal structures as well as the physical geography of the region. On the superstructural level, time is taken in the broadest meaning possible: clock and calendar are essential in running the system, but paratimes, social time especially, direct the decision-making as well. In Hägerstand's terms, the authority constraint works on the superstructural level while the actors on this level also produce and shape the authority constraint. This happens through national and regional politics and the economic outcomes of the policies applied, and affects the regional distribution of societal functions as well as the distribution of political and economic power between the superstructural organizations and institutions.

Analogous to the infrastructural level in the structuralistic model are Parkes and Thrift's *levels of environment and activity*. Environmental level imposes physical constraints on individuals, which could be associated with Hägerstand's coupling constraint. The level of activity is the stage of the everyday activities of individuals, which are constrained by all of the constraints to human activity. Time and space appear more strictly defined and physical on the levels of environment and activity than on the superstructural level. These levels correspond to Hägerstrand's time geographic framework: The level of environment equals space, and human activity is captured by the trajectories of individuals. People's *attitudes and perceptions* of the society compose the lowest level in Parkes and Thrift's model, and are compatible with the deep structures of the structuralistic model. I see the life times, both biological and psychological, functioning on this level as both the physiological needs and individual characteristics and values form the deep structures. The left hand side of Figure 3 presents Parkes and Thrift's model of the society with reference to the different concepts of time and constraints to activity in comparison to the structuralistic model

It is noteworthy that paratimes seem to be present in the highest and the lowest level of the structuralistic model of the society, while the infrastructure, or the levels of the environment and activity, runs in clock time. This is in accordance with the structuralistic approach to the study of societies, since it emphasizes that although we

can observe the activities in superstructure and deep structures, we cannot grasp or even consciously identify the mechanisms of these activities. Thus, we are left with the level of physical environment and everyday activity, which we can measure by using clocks and maps, and model with theoretical tools. This brings us back to the original time-geographical framework, and presents it as a practical device in study of the society.

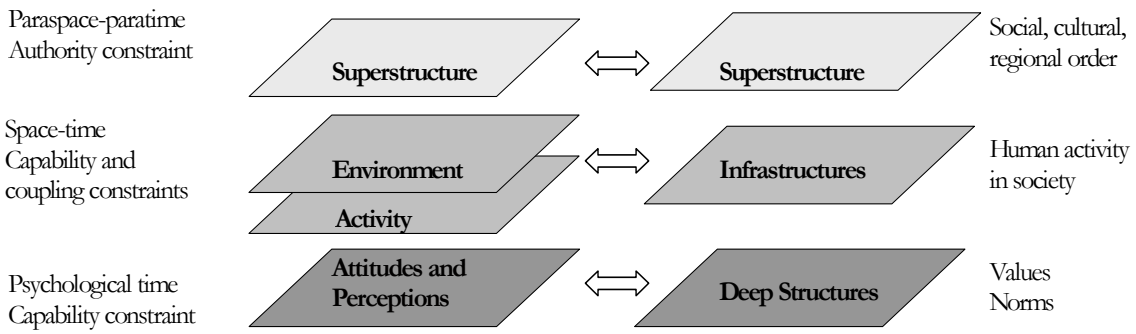

Figure 3. Structuralistic view of the society according to Häkli (1999: 98) on the right and the chronogeographic model by Parkes and Thrift (1978: 119–120) with time-geographical constraints to activity on the left.

2.5. Time-geographical research

A host of time-geographic research has dealt with regional planning, transportation networks, and life-span analysis as well as analysis of quality of life (Mårtensson 1979; Lenntorp 1976; Heikkilä 1987). The origin of time geography has been placed to a study by Hägerstrand on migration flows in 1962 (Heikkilä 1987: 2). The scope of research can range from one person to the society at large, and similarly the timeframe can be one day or a lifetime. In research connected to regional or social planning, simulation models that allow for variation in individual, environmental, and transportation characteristics, for example, are often used. The PESASP model (Program Evaluating a Set of Alternative Sample Paths) is this kind of a tool to model urban regions and simulate activities (Lenntorp 1979: 166). By alternating the constraints to activity and characteristics of the environment, the trajectory choices available to individuals can be studied.

Solveig Mårtensson worked with the group of geographers who developed the time-geographical framework and conceptual system and was headed by Hägerstrand (Mårtensson 1979: 8). Her work *On the formation of biographies in space-time environments* is one of the earliest publications within the field of time geography. The three cases into which she has applied the then novel framework give an overview of the potential directions that can be taken. I find introducing the time-geographical research through work intimately connected to the beginnings of time-geographical research suited for this work, which in turn does not adhere to the tradition all that closely.

Mårtensson's case studies examine relocation of a workplace, comparing regions with respect to daily living conditions, and childhood interaction and temporal organization. Common themes in the case studies are the conditions of daily life in different environments, and the studies present "examples of general ideas about the relation between the action space of individuals and the structure of society in terms of its rules and routines in space and time" (Mårtensson 1979: 30). Although Mårtensson does not use Hägerstrand's vocabulary, she is clearly emphasizing the authority constraint as a determinant of individuals' trajectories in space-time. The relationship of routines and stability to change and development become another common theme. In the first study, the effects of relocating the National College of Forestry from Stockholm to Umeå on the employees' and their families' lives are examined. These people are faced with the "choice of continuing in their accustomed job and moving to a completely different environment, or remaining in their accustomed environment and being obliged to look for another workplace" (Mårtensson 1979: 66). The second study compares the possibilities of carrying out identical daily trajectories in three different regions in Sweden. It examines the goal of equality in the contemporary Swedish regional politics, which can be viewed from two perspectives: either the differences between regions or the inequality between groups of people can produce unequal distribution of activity possibilities (Mårtensson 1979: 26). The third case deals with households with young children and two working parents. It considers the daily activity program of a child as a reflection of that of the parents'. The main question in this study is "how can the activity organization of a community influence child development possibilities" (Mårtensson 1979: 105). Values, rules, and routines shape the activity organization of a

community and individuals constituting it, and they are examined from the viewpoint of children concerning their social contacts as an indicator of conditions for development.

In the first study Mårtensson uses data collected by a survey administered among the employees working at the College of Forestry when the move was being planned. In the second study statistical data of time-use is used to construct the activity program then placed in the time-spaces characteristic to the regions compared. Daily schedules and data on attendance in day-care centres are utilized in the third study. All data include information on the time use of the individuals and the location of their activities. They differ from each other, however, and illustrate the fact that incorporating space and time can time happen in different levels of detail. Same goes with the samples and methods used: An entire family can be asked to keep a time use diary, or one activity of one member of a family can be recorded, and still the basic question of the relationship between an individual or a household and the physical and social environment can be approached.

Mårtensson finds in the relocation case that individuals are prone to maintaining the activity programs they currently possess even after the move. Therefore, the information they have on the physical and social environment of the new location is vital in making the decision whether to move or not. Relative locations of work and home, social and professional contacts, and leisure habits are factors Mårtensson finds significant. However, for individuals in different family and with different tasks in the workplace and situations these factors come in different order of importance. Similarly, the situation may become worse in one respect but improve in another due to relocation. Certainly anyone is willing to make a decision that allows for more leisure, for example, but uncertainty about the reality after the change may inhibit the decision if there is a risk to end up worse.

When comparing three regions with respect to the possibilities to engage in specific activity programs, differences in the living conditions are found both between regions and between groups of people within regions. Access to transportation is a source for such intra-region differences as is the connectedness of central and more distant

locations within a region. Mårtensson (1979: 99) also finds that certain characteristics of the service locations and opening hours reinforce these differences.

The results from the study on childhood interaction and temporal organization include that establishing secure routines and regular contacts for children in day-care is hindered by poorly matching time schedules of families and the childcare providers (Mårtensson, 1979: 140). A purely location-related result is that especially for children cared for in large facilities the trip to the day-care and back home tends to be long and thus requires a large share of the time the parents and the children spend together (Mårtensson 1979: 141). Interestingly, Mårtensson also points out that the range of contacts with people and objects is narrow for the children studied: They rarely meet adults other than those providing their care, who in addition tend to be a homogeneous group: women of about the same age. They have access to a limited array of objects and toys to play with that are consider appropriate, educational, and safe (Mårtensson 1979: 141).

In all three case studies, the authority constraint is found to have an impact on the formation of the biographies, or stretches thereof, of individuals and households. Engaging in this work some 25 years later, I have the advantage of subsequent time-geographical research. In this work, I examine the effects of authority constraint on the allocation of working time between home and workplace. The authority constraint obviously has an impact on the notions of experiental space and time of individuals, as was the case with children given only generally accepted, conventional toys to play with. Another example, dealing with time use is that in a society with low female labour force participation the space-time in which women operate is more likely to be centred around the home with the experiental element of time relating to the role of women as caregivers and suppliers of household work. Similarly, if the social security and pension systems are generous on the one hand, or household work is valued highly in a society on the other, individuals would attach a high value on work done at home and be more likely to choose to do less paid work. The societal norm regarding the commitment to one's work increases the weight the workplace gets in the allocation of time across space. Relating to the structuralistic view of the society, the behaviour of the individuals as members of their societies is perceived as the superstructural level in paraspace-

paratime, although the actual daily trajectories exist in the space-time of the infrastructural level.

3. THEORY OF ALLOCATION OF TIME

3.1. Household production model and allocation of time

The point of departure for considering the value of household work as a component of a person's utility comes from the economic theory of allocation of time. Gary S. Becker (1965) first presented the theory, which treats households as producers of non-market goods. These include a clean home, meals, and care for family members, for example. The inputs required are market goods and services, and the household members' time and abilities. The combination of market and non-market goods the household decides to consume determines the allocation of time between work, domestic work, leisure, and other activities. Work and household work are considered forms of production, and other activities are treated as consumption. Consumption decisions are constrained by the time needed in the activities and by the consumers' money income. More time allocated to work means more income but at the same time less time for consumption. The goal is an allocation of time that maximizes the utility of the household members. Utility is a measure of satisfaction or wellbeing of an individual commonly applied in economics and expressed as functions of its determinants. Solving for the allocation of time or resources in a way that maximizes utility usually requires simplifying the notion of overall satisfaction, and setting utility equal to income. Intangible factors contributing to an individual's utility may be assigned a value in money terms in order to incorporate them into the utility function.

In Becker's theory, the household utility is

$$U = U(Z_i, ...Z_m) \equiv U(f_i, ...f_m) \equiv U(x_i, ...x_m; T_i, ...T_m) \qquad (1)$$

where households' basic commodities from Z_i to Z_m enter directly the utility function in the first part of Equation 1. The utility can also be thought of as the combination of the production functions f_i to f_m for the different household commodities, as the

second part of Equation 1 lays out. Finally the household's utility can be broken down to the inputs into the production of household commodities: market goods x_i to x_m, and time required in the production of each commodity, T_i to T_i. Household commodities can thus be expressed as a function of market goods and time

$$Z_i = f(x_{i,} T_i) \qquad (2)$$

The expenditure of market goods (x_i) and time (T_i) in the production of household goods introduce separate constraints, subject to which the utility function is maximized. Let T=total time available, T_c=hours spent at consumption, T_w=hours spent at work, t_i=time input required in order to produce one unit of a household good Z_i and x_i=input of market good per unit of Z_i. The time and goods constraints (3a-b) express the amounts of time and market goods available in terms of income and total time at the household's disposal. In the time constraint, the total time used in the production of household commodities $\left(\sum T_i\right)$ is defined as the time left over when working time (T_w) is subtracted from total time available (T). In the goods constraint, p_i is the price of the market good x_i. The total price of all market goods used $\left(\sum p_i x_i\right)$ can only be equal to the total income I, which is broken down into wage income from work $T_w \overline{w}$, where $\overline{w}$ is the hourly wage from work, and other money income V such as income from assets or property. Since household commodities are a function of market goods and time, these can also be defined as functions of time and household commodities, and market goods and household commodities, respectively. Equation (3c) expresses these functions

a) Time constraint $\quad \sum T_i = T - T_w$

b) Goods constraint $\quad \sum p_i x_i = I = V + T_w \overline{w}$ (3a-c)

c) Production functions $x_i \equiv t_i Z_i$

$T_i \equiv x_i Z_i$

By letting π_i stand for the full price of household commodities, including the time used in production and the prices of market goods used, and *S'* to stand for full income in Equations (4a-b), the time and goods constraints can be reduced to a single constraint in Equation (4c).

a) Full price	$\pi_i \equiv p_i b_i + t_i \overline{w}$	
b) Full income	$S' \equiv V + T_w \overline{w}$	(4a-c)
c) Single constraint to production of household commodities	$\sum \pi_i Z_i = S'$	

Becker's approach does not allow for separate valuation of paid work and household work, however. This is essential for the purposes of ETLA's contribution to the AGIR project and this work, since the objective is to capture the increase in utility from the increased supply of household work after retirement. Thus, the utility from household work (U_h) is taken separable in Equation 5, and the overall utility consists of utility from work (U_w) and utility from household work. Becker's utility function is thus reformulated as follows:

$$U = U_w + U_h \equiv U_w(x_i ... x_m; T_i ... T_m) + U_h(x_j ... x_n; T_j ... T_n) \qquad (5)$$

Utility from work is the function of market goods consumed (x_i to x_m) and the time used (T_i to T_m) in the consumption, constrained by income and time available as in *(4a-b)*. Similarly, utility from household work is a function of goods (x_j to x_n) and time (T_j to T_n) used in the production of household goods, and subject to the same constraints.

When applied to empirical situations this approach to utility requires consideration of distortions created by taxes on wages and consumption. Expressing the commodities consumed in different activities contributing to the overall utility yields $Z_w \equiv \sum p_w x_w$ and $Z_h \equiv \sum p_h x_h$, which express the consumption related to paid work and household

work as aggregate commodities Z_w Z_h, respectively. Assuming that household work and consumption cannot be traded at the market, the consumption and production of household work are equal as in Equation 6.

$$Z_h = T_h w_h \tag{6}$$

Since paid work is traded at the market, as the employer supplies labour in return of wage income, the tax treatment of income has to be considered in the goods constraint.

$$Z_w + Z_d = I = T_w w(1 - M_s - M_m - M_k) + T_h w_h \tag{7}$$

In equation *(7)* the term $T_w w(1 - M_s - M_m - M_k)$ expresses the value of paid work. Again T_w is the time spent in paid work while *w* represents the gross wage. The net value of paid work is arrived at by multiplying the gross wage by 1 minus the taxes rates levied on wages. These are

M_s The effect of social security payments by the employer on the wages of employees

M_m The effect of wage tax rate

M_k The effect of consumption tax rate

The detailed formulae for the tax effects are presented in Appendix 1. Other income than that from wages (*V* in Equation 3b*)* is ignored in Equation 7 because in this work income from wages is taken to represent the utility from paid work. If included, capital income would be subject to the relevant tax rate. It is seen that taxes distort the value of paid work unlike the value of household work, which is free from this distortion because it is not traded at the market.

Introducing household commodities as separable into the utility function also has an effect on the time constraint, which now becomes

$$\sum T_i = T_c = T - T_w - T_h \qquad (8)$$

as T_h enters the constraint. Spending more time on household work is away form the time on paid work or consumption. The allocation of resources between domestic work and market work such that the overall utility is maximized occurs at a combination of paid and household work where the marginal utility from either one is the same. Formally:

$$\frac{\partial U_w / \partial Z_w}{\partial U_d / \partial Z_d} = 1 \qquad (9)$$

This implies that the individual considering whether to spend the next hour in paid or in household work is indifferent between the choices in terms of the utility derived from these activities. Neither choice would increase his wellbeing, and utility is thus maximized at current allocation of time. This combination of T_w and T_h can then be used to determine the time left for leisure T_c.

3.2. Time Use Research

Time and its use by individuals and societies are of value as objects of research and have much to tell about the societies' and individuals' behaviour. Time use research exists mainly within social sciences, where sociologists and economists have engaged in the study of the allocation of this scarce resource. However, the views taken on time in the formulation of research questions differ a great deal from study to study and field of science to another. Juster and Stafford (1991: 471) begin with their literature review of time use research by stating that "It can be argued that the fundamental scarce resource in the economy is availability of human time". They represent the time use research within the field of economics, and continue to identify the allocation of time as the

determinant of the relative prices of goods and services and the growth path of the economy. Parkes and Thrift (1980: 146) remind us, however, that although scarce due to the constraints to activity and the number of activity choices available, time is of equal quantity for everyone. We all, regardless of social status or income, possess 24 hours a day to allocate at our will, remembering the constraints posed by the basic activities we all have to perform. Since the distribution of time is ubiquitous, the allocation problem is somewhat different than the one regarding factors of production such as labour and capital or scarce raw materials. Time cannot be budgeted in the common economic sense of balancing income and expenditure: it can only be spent in different ways and with varying productivity, not earned or put aside for later use (Little 1984: 4). In spite of this difference in the nature of time as a scarce resource, data of time use are often called time budgets. Even though this is not an entirely accurate description of a time use schedule, it does follow the idea that people try to allocate their time in a way that maximizes their utility.

Common to all time use research are the challenges involved in the collection of data. It is time-consuming and expensive to gather reliable accounts of individual time use by diary surveys. This method is, however, considered the most effective and fruitful among the alternatives. Respondents report their time use more accurately in a diary than for example in a survey with stylized time use questions of the type "how many hours a week do you work?". The time spent in activities, especially in paid work, tend to be over-reported, and the observations cluster around numbers that could be expected or easy answers, such as 40 hours of paid work a week. Consequently, in stylized question survey data, the hours of activity per week usually total at considerably more than the 168 available (Juster and Stafford 1991: 484–486). This is, of course, partly due to simultaneous activities, which cannot be assigned to the same time slot in a survey with stylized questions. The most commonly supported and used method is thus the time use diary. It can be either an actual diary where the respondent writes down his or her activities, or the information can be collected in an interview regarding the respondent's activities on the day before or some other day preferably not very far in the recent past. Either the starting time and duration of each activity is recorded, or there are time slots, usually of ten or fifteen minutes, that are filled in with the activity taking place at that time. The place and other participants in the activity are also usually

recorded, as well as secondary activities taking place simultaneously with the principal activity (Andorka 1987: 150). These may be keeping company to someone while cooking, or cleaning up the house while providing childcare, for example. For intertemporal and international comparability, the demographic and socio-economic background information linked to the diary data, as well as the data coding and the numbers of activity classes have become relatively established and consistent within time use research.

The first time use studies and collection of time use data were conducted in the 1920s in the Soviet Union. The following decades saw small individual studies in Europe, until in the 1960s a Hungarian sociologist *Alexander Szalai* initiated the first effort to collect methodologically comparable data from several countries. Results are reported in an extensive work *The Use of Time* (1972). However, his data are samples of the populations of former Soviet Union and East European cities, and thus not perfectly comparable to more recent, national time use survey data. In the late 1980s, efforts began to compile a comparable international time use database of national diary survey data (Gauthier et al. 2000). Professor *Jonathan Gershuny* has lead the development of the *Multinational Time Use Study* (MTUS) data set since then. Currently the harmonization efforts have taken a new form. *Eurostat*, the statistical office of the European Union, has launched the *Harmonised European Time Use Study* (HETUS) data collection guidelines, which have been in effect since the late 1990s. Currently, setting up a database of data collected according to these guidelines and using it to form national satellite accounts of household production are being planned (Eurostat 2003).

Some trends emerge from time use studies since the early twentieth century. These include the decrease in working time, different trends in household work for men and women, and the increase in leisure time. Hours spent in paid work have decreased in all countries, from which time use data are available from the earlier part of the twentieth century (Gershuny 2000: 63; Ausubel and Grübler 1995: 115). However, since the 1980s the trend has reversed for some countries. The working time of women has increased since the 1960s due to the increasing participation of women in the labour force. Controlling for this change in the participation by setting the first year of data as a base year with respect to being in paid work, the upward trend disappears or is diminished

significantly (Gershuny 2000: 124–125). Gershuny also plots the working hour trends against the gross domestic products of countries, and finds that the richer the countries get, the shorter the working hours become for men, while the reverse is true for women due to the mentioned increase in participation in paid work (Gershuny 2000: 111–117). Time spent in household work has developed differently for men and women. Along with the increase in the female labour force participation, there has been a decrease in the household work times. This can be seen both in relation to the level of economic development of the country and in time. Again, when controlling for the structural change in the female labour market behaviour the decline becomes substantially smaller (Gershuny 2000: 114 and 126). Thus, Gershuny concludes that a significant portion of the decrease in time spent in household work is due to increase in the time spent in paid work, but the elasticity of women's unpaid work with respect to paid work hours is less than unity: When increasing their working time by one hour they reduce the time spent in household work by less than one and end up with longer total work hours. The trend in household work for men is the opposite of that for women. Since the 1960s, the household work times of men have increased (Gershuny 2000: 129).

The most powerful argument behind the decrease in the hours of paid work during the industrial and post-industrial is that technological development has improved the efficiency of work. At the same time, the household has also become equipped with an increasing number of devices and machines making it faster and easier to do the household chores. The time spent in household work has not decreased accordingly, however. An explanation could be that tastes and preferences have changed together with the technology: We want the house to be the cleaner the better equipment we have for cleaning it, and develop a taste for new and more complicated foods as they become available. There is also evidence for a change in the composition of household work. Women allocate relatively more time toward household work other than the core routine duties. These include shopping and maintenance-related or do-it-yourself activities (Gershuny 2000: 129). It could be that as material wealth increases we "invent" new household duties by paying more attention to interior design or replacing durable household goods more often than before.

Both men and women seem to enjoy an increase in leisure time as their countries get richer measured by GDP (Gershuny 2000: 116). Remembering the implications of economic development to time use in the previous section, this makes sense. Since there no longer is only the small elite who has "free time" and the overall working times are decreasing, more time should be left for leisure or consumption. This is in accordance with the increasing efficiency of production and the economic growth: Consumption is essential in spurring more production. In the theory of allocation of time, time not used in work, i.e. production, is considered consumption. With economic growth, not only the amount of leisure increases, but also the nature of leisure must change. The shift toward a high-value added service economy not only refers to jobs and production but also to goods and services consumed.

The overall trends visible in multinational time use data are outlined above. There are substantial differences among countries as one takes a closer look. Ausubel and Grübler (1995: 117) show that from 1870 to 1987 the annual hours worked have decreased in Europe, the United States and Japan but that there are different patterns in the decrease. After the 1930s the decrease has been slower in Japan while European countries and the US have continued to show a similar trend. Gershuny (2000: 53) points out an increase in working times in the UK since 1980s at least in manual labour, and a similar upward turn is observed in Canada as well. Continental Europe or the Nordic countries do not exhibit this kind of development. The difficulty in proving these observed differences between countries to be real lies at the core of time use of individuals. Do we assume that individual characteristics determine the time use of people, or do we allow for "the country variable" to have an effect of its own? If social, economic, and demographic characteristics alone explain time use behaviour, then the differences between countries depend on the distribution of these characteristics and the age structure of the population, for example. If, on the other hand, nationality or the location of a country has an effect, controlling for the socioeconomic and demographic variables should leave some of the country differences unchanged. In fact, Gershuny (2000: 159) comes after decomposing the variance in time use in nine countries by the effect of different independent variables to the conclusion that "a Dutch woman's daily pattern of life has, arguably, more in common with that of a North American woman than of a Dutch man". However, not all the variance can be explained by the demographic and

socioeconomic variables. Gershuny (2000: 158) admits that especially with household work this "universal" model of time use does not capture the differences between men and women. Also, the possible interaction between the individual and country variables remains to be discovered, and more importantly, considering a more narrowly defined group of people in a life situation such as retirement decision allows a more detailed look at the role of national differences in social security and tax systems and their effects on individual time use.

4. WELFARE REGIMES

4.1. Welfare regime typologies according to Esping-Andersen and Kosonen

Individuals' movement in space-time is constrained by the authority constraint, along with the capability and coupling constraints. In this work, the authority constraint has two elements. First, the social security, tax, and pension systems in each country, along with cultural and political characteristics form the immediate authority constraint individuals face. This enables the search for differences between the countries studied. Second, grouping countries into regimes by the type of welfare state they exhibit represents the authority constraint on the European level, and takes the comparison a step further. This is relevant to comparative research with respect to European integration and the future of its welfare states since convergence in cultural and economic factors strengthen the interdependencies between countries (Kosonen 1994: 9). On the other hand, similarities in the authority constraints can also be seen as a precondition for integration in the first place, which further illustrates the appropriateness of considering the authority constraint as a factor in the functioning of economies and the trajectories of individuals.

Gøsta Esping-Andersen (1990: 26–29) describes three regimes of welfare based on interrelations between the functional strata in the society. The classification is based on the historical legacy of institutionalisation, class-political stratification, and mobility between classes. Esping-Andersen's regimes are

1. The Liberal regime, where the state only guarantees a minimum level of welfare through assistance or subsidies, and the labour market is upheld by traditional, liberal work ethic norms. "Making your own man" by hard work and taking the responsibility for one's success or misfortune describe the attitude. The society of the liberal type of welfare regime is dualistic, with relatively high inequality in the economic wellbeing between the well-to-do and those who subsist on the minimum wage. Esping-Andersen classifies e.g. The United States, Canada, Australia, and the United Kingdom into the liberal welfare regime.

2. Conservative, or Corporatist welfare regime has its roots in the strong influence of social class as a determinant of social rights, and continues to harbour status differences with its relatively small redistributive effects. The role of religion, and the Catholic Church in particular, both in politics and as a provider of services and sense of community is strong. Partly due to this, the family and related gender norms are of great significance in shaping the labour market, for example. Traditionally, the participation of women in paid work is low. Of European countries, Esping-Andersen finds Austria, France, Germany, and Italy representative of the conservative regime.

3. The Scandinavian countries represent the Social Democratic welfare system at its purest. The welfare regime built on the ideal of the equality of highest standards, not of minimum needs, and high level of universalism both in benefits and payments characterize the Social Democratic welfare regime. Everyone is covered by the public welfare system regardless of his or her income or social status. On the other hand, the strong public effort in providing these services has hindered the growth of the private sector in the field of health care and social services, for example.

Pekka Kosonen (1995: 23) discusses Esping-Andersen's classification in relation to methodology of comparative research and the European integration, and presents his own categorization of welfare regimes in Europe, which is employed in this work as well. His classification entails four schemes present in the Western Europe: *The Nordic, Continental, Peripheral, and British* welfare regimes. While Esping-Andersen includes the

British society into the liberal regime, Kosonen argues that Britain was one of the early welfare states with a broad system of social insurance and public services developed during the time period between the World Wars. More recently, with the reorganization of its welfare system, the country has taken a step towards neo-liberalism. However, Britain still does not, according to Kosonen, qualify for a liberal welfare state like The United States or Australia, where the liberal regime has been the norm from the early days of statehood. In the European context, Kosonen presents Britain as a regime of its own.

The Continental regime is close to Esping-Andersen's Conservative type of welfare state, but Kosonen differentiates further the Peripheral regime. This distinction according to the location within the region emphasizes the dynamics of the regional development and the political and economic integration of Europe. Kosonen lists the Southern European countries Greece, Portugal and Spain in the Peripheral regime. Moreover, Kosonen's classification seems more appropriate when taking the geographical viewpoint, as it both in the nomenclature and argumentation accounts for location in relation to the core-periphery structure of Europe.

Kosonen finds clear relationships between the regimes and for example female labour force participation, public social expenditure, and employment levels. In terms of social security systems and the labour market structure the Scandinavian and British regimes represent universal coverage and a strong role of the public sector in the economy, while the opposite holds in the Continental and the Peripheral regimes. Similarly, female labour force participation is high in the first two and low in the latter pair of regimes. In the Scandinavian regime the female labour force participation as well as the public sector employment are higher than in the British regime, and the Peripheral regime has the lowest shares, differing thus from the Continental regime (Kosonen 1995: 33-45). Table 2 presents Kosonen's classification with short characterizations of the welfare regimes and examples of countries falling into them, as well as references to Esping-Andersen's typology.

Table 2. Typology of welfare regimes and characteristics of the social security systems and labour markets according to Kosonen (1995).

Esping-Andersen	**Social Democratic**	**Conservative/Corporatist**		**Liberal**
Kosonen	**Nordic**	**Continental**	**Peripheral**	**British**
Countries	*Finland*, Sweden, Norway, Iceland, *Denmark*	*Belgium, Germany*, Italy, Luxembourg, *Netherlands, Austria*, Switzerland	Greece, *Portugal*, Spain	*The United Kingdom*
Social security systems	Share of public social expenditure of GDP high	Share of public social expenditure of GDP high	Share of public social expenditure of GDP low	Share of public social expenditure of GDP high
	Welfare services universal	Welfare services restricted	Welfare services restricted	Welfare services universal
Structure of the labour market	Female labour force participation high	Female labour force participation low	Female labour force participation low	Female labour force participation high
	Public sector employment high	Public sector employment low	Public sector employment low	Public sector employment high

Italics: countries included the study

4.2 Time use regimes

The level of economic development and the structure of the society, as well as the welfare regime arguably affect the time use of the population. Gershuny (2000: 33–45) presents a classification of countries into time-use regimes according to alternative structures of the service economy. As a background to this observed difference in time-use, he describes the process of development and economic growth in Europe from pre-industrial to post-modern economies. When time use is viewed against this background it appears as "not a mere *indicator* of social change; it is itself part of the *essence* of social change" (Gershuny 2000: 19). Economic development has through improved technical efficiency allowed societies to allocate more of their time towards activities not related to satisfying the basic needs. This translates into a shift from production and consumption of low-value added goods to production and consumption of high-value added goods. Table 3 outlines the socio-economic development from pre-industrial through industrializing to post-industrial societies and its implications to time use in production and consumption, as well as differences in time use with respect to social status and gender.

Table 3. A historical view on time use and economic development (Gershuny 2000: 32).

Society	Time use	Status	Gender
Pre-Industrial	long hours in subsistence work	Small elite with leisure, no difference for others	Strong specialization in time use and
Industrial	long hours for the subordinate class	Strong differentiation in time use with respect to social class	Strong specialization in time use and
Post-Industrial	Decreasing work hours, increasing consumption	Converging work time patterns	Decreasing specialization in time use and work

With convergence in working times with respect to class and gender the time use patterns of these groups have become more similar. Keeping in mind the overall decrease in working hours and the shift towards high-value added production and consumption we can also state that the nature of free time has changed. Differences between countries do exist, however, and Gershuny has applied the concept of welfare regimes to time use.

The existing extremes of time use regimes are, according to Gershuny, the Liberal market economy and Social Democratic system as the centrally planned economies of Eastern Europe have entered or completed a transition towards the market economy (Table 4). Examples of the current different service economies are the United Kingdom for the Liberal and Finland for the Social Democratic economy (Gershuny 2000: 42–45). The implication to this work is that Gershuny mentions the source of domestic services work as a determinant of time use regimes: In the Liberal market economy, women's unpaid work and work for low wage is the main source of household work. In the Social Democratic time use regime, unpaid work by both genders is the source of domestic work supply (Gershuny 2000: 44).

Table 4. Time use regimes according to Gershuny (2000: 44).

Economy	Distributive characteristics	Wage differentials	Income dispersion	National income	Source of domestic work
Centrally planned	Relatively egalitarian	Small	Low	Low	Women's unpaid work
Social democratic	Relatively egalitarian	Large	Low	High	Women's and men's unpaid work
Liberal market	Relatively inegalitarian	Large	High	Medium	Women's unpaid work, paid work for low wages

5. DATA AND METHODS

5.1 MTUS data set

The empirical part of this work contributes also to the AGIR project, and also the data are common to both studies. An important source of data is the Multinational Time Use Study (MTUS) database, the collection and maintenance of which is overseen by *the Institute of Social and Economic Research* at the University of Essex, UK, in collaboration with several national statistics bureaus and other academic institutions. It includes harmonized time use data from time use surveys conducted in 24 countries, with the earliest studies dating back to the 1960s, and the latest ones having been done in the most recent years. The data have been gathered by administering time use diary surveys and linking the results to background information on the respondents, and combining them into a database with comparability across surveys and countries (Gauthier et al. 2002).

In addition to the harmonized set of data, the MTUS team has given us access to the original data from six of the countries included in this study. Data from Portugal and Belgium are not original, but cross-tabulations by employment status, gender, and time use categories. The national surveys include a somewhat different set of questions and also the extent of the socio-economic background information differs from country to country. However, for the purposes of this study the original data are more suitable, although more laborious to analyse due to the different formats, coding, and languages used. The MTUS set only includes individuals 60 years old or younger, while the original sets have no age limitations. Since the decision to retire is of interest here, extending the sample to those approaching the official retirement age, 65 years in most countries, is at place. In addition to more work, the use original data brings with it also room for doubt in comparability. The quality and accuracy of the data differ across countries, and some variables do not exist in all of them. Such variables were constructed "by hand", and may not be entirely identical in design with their "ready-made" counterparts in other data sets.

For the most part, the surveys have been conducted by distributing time-use diary forms to the respondents, in which they have been asked to keep record of their activities

during the day in ten or fifteen minute intervals. National statistical offices, or corresponding organizations, have conducted the surveys. Some countries' data have been collected by telephone interviews, but the structure of the forms used has been similar. Persons have usually kept the diary on one day during the week and on one weekend day. Weights to correct for the weekday are either provided with the data, or have been constructed them based on information on the day of week of the diary day. From the data sets, individuals of the age between 45 and 64 are selected for the analysis, because they are considered the relevant group for examining the decision to retire. Most of them have been in the labour force and contributed to the public pension schemes for long enough to qualify for pension benefits once they reach the legal retirement age. The sample sizes vary between 573 diary days for Great Britain and 3 643 dairy days in the case of Germany. The original data sets were selected so that the surveys would have been conducted as recently and as close to each other in time as possible. The survey years range from 1987 (Denmark) to 2000 (Finland).

The MTUS data allows for some longitudinal analysis as well, since several countries have provided the MTUS with data from successive national surveys. In this work, however, the approach is cross-sectional, partly to facilitate the financial incentive calculations, and partly to reach the best possible comparability. Of course, being able to track the same individuals through the transition from work to retirement would allow capturing changes in time use due to retirement, and more accurate incentive calculations. No longitudinal surveys support this kind of panel structure, however. Time used in household work has been calculated for the employed and the employed separately, and the differences between the two groups serve as a proxy for the change in time-use after retirement.

5.2. Documentation and valuation of time use in household work

Valuation of household work involves two steps: first we have to account for the time allocated in these activities and second, an economic value has to be assigned to the time. In this work, household work is defined as activities that are performed without pay, and are related to the upkeep of the household and providing for its members. It includes housework such as cooking, cleaning, laundry, childcare, shopping,

maintenance-related odd jobs, and related travel. For the purposes of this study, the time use is additionally divided into three other main categories: work, leisure, and basic needs. Work includes all paid work, including breaks during the workday, and related education, leisure entails time used in social activities (visiting friends, conversation, eating out etc.), and hobbies and recreation. Basic needs cover the activities involving personal care, hygiene, eating, and sleep.

Travel between home and workplace is included in working time, making the category representative of total working time, i.e. total work-related time away from other time-use, not a measure of productive work. This approach is appropriate when considering individual decision-making, since the total length of a workday has more significance for a person and his or her family than how long each activity during the day takes. Other travel, with the exception of recreational travel, is considered as a separate time-use category, making the main time use classes add up to five. Travel for purposes of recreation is considered to be recreational in nature. Not including travel times related to household duties into the measure of household work may distort the results on individual level, but in general can be viewed as a way to correct for the possible lack in the regional representativeness of the data. Omitting the travel times may thus help fight the possible bias towards metropolitan areas, for example.

The choice of the measure of the value of household work time is not straightforward. There are several ways to value time depending on the theoretical approach to the optimization problem facing the individual. In addition, whether operating on the micro or the macro scale affects the choice of measure. A large part of exercises aiming at valuing time have dealt with amending national accounting to include non-market work in addition to market production. In these cases the measures used have tended to differ according to the production or welfare orientation of the system (Juster and Stafford 1991: 506). In systems taking the former view, the valuation of non-market time has been cost- based. The two alternative measures for the value of household work in this case are the cost of buying the service from the market or choosing to value the time with the amount of money saved by doing the job oneself. In either case, the value is essentially determined by the wage rate of a provider of such a household service added with any excess costs.

If the aim of the accounting system is to measure welfare, rather than the production cost of household work, the value of the forgone alternative activity is often chosen. Thus for an employed person, the value of an hour spent in household work is valued at his or her wage rate from market work. Juster and Stafford (1991: 506) discuss the strengths and the weaknesses of these valuing methods, and point out that valuing non-market work at the person's own wage yield biased estimates for individuals not employed. Furthermore, whichever wage rate is applied, the preferences of household members and the leisure utility of household work are always ignored.

This work is clearly of the welfare oriented kind because we are considering individual decisions and not national accounts. Nevertheless, the choice of a person's own wage rate as the value of household work is not appropriate here because of several reasons. First, the incomes would rise implausibly high with own wage rate. The non-employed do not receive a wage, and the value of their household would remain without a measure. Furthermore, the alternative own income measure for the retired, pension income, is not a measure of the value any foregone activity as is own wage rate. Second, the net wage of a household worker in each country entails many aspects of the society and the market for such work that we want to be able to account for at least to some extent. Third, using the net wage for household work captures some of the intuition that for people with lower own wage rates the value of household work can be relatively higher than for high-income individuals. Further, even if household work services were bought from the market, the amount demanded would generally be a fixed number of hours per week. Thus the household work performed at the margin would still be done by household members themselves, and the value of the work, not the cost of hiring help, is the appropriate measure of the value of household work.

Table 5 provides the values of household work applied in the valuing of household work in euros per hour. These were provided by the AGIR project partners in each country (see Appendix 2 for a list of partner organizations). The wage costs to the employer include the social security payments paid by the employer, which equal the difference between the wage costs and the gross wage. The difference between the gross and net wages includes the social security payments made by the employee and income

tax. The net wage applied for Denmark was obtained differently, and no incentive calculations have been performed for Austria, which is why these countries do not appear in the table. Figures for France are presented for comparison although it is not included in the study otherwise.

Table 5. Wage rates for household work (€ per hour) in each country. Information provided by AGIR partners.

	Belgium	France	Finland	Germany	Netherlands	Portugal	UK
Wage costs to employer	8.96	11.12	12.84	9.63	7.43	2.12	6.31
Gross wage	7.07	8.35	9.80	8.00	7.00	1.89	6.31
Net wage	3.10	6.83	7.76	5.13	5.86	1.52	6.30

The economic value of an hour devoted to household work is, in the case of Finland, the net hourly wage of a communal household help worker. After accounting for taxes and social security payments as described above, the net hourly rate of € 7.76 is acquired. Since the public sector involvement in providing household help to the elderly or handicapped differs a great deal from country to country, and in some countries hiring private help is more common, it was essential to get the information from sources who know and are better able to evaluate which wage rate best describes the valuation of household work in each country. Even an estimate of the black market wage of a domestic servant was welcomed in the initial enquiries to the partner organizations, but in the end all the wage rates applied are either household helper or minimum wages.

5.3 Net replacement rate

A replacement rate in financial incentive calculations generally refers to the ratio of a benefit or transfer that replaces income from work to wage income (Viitamäki 1995: 18). Net replacement rate considers benefits and income net of taxes and social security payments, and is commonly used to evaluate the social security and pension systems (Gruber and Wise 1999; Ruuskanen 1997). Here the net replacement rate (*NRR)* expresses an individual's net pension income *(P)* at age *a,* based on earnings prior to

retirement (Y_{r-1}) plus the value of household work when retired (H_{ret}) as a percentage of net wage income (Y) added with the value of household work when employed (H_{emp}).

$$NRR = \frac{P(a, Y_{r-1}) + H_{ret}}{Y + H_{emp}} \qquad (10)$$

In this work, the net replacement rates for each successive year of potential working have been calculated starting at the age of 55. At this age, employees in most countries still have 10 years of work ahead of them until they qualify for official old-age pensions. However, considering retiring may in practice be very current for them since early retirement schemes, and private retirement insurance schemes allow for earlier retirement.

The effect of household work on net replacement rate, and thus on the decision to retire, are examined for three income levels. These levels have been derived from the statistical concept of average production worker (APW) by OECD: individuals who earn the APW wage are full-time production workers in the manufacturing sector whose earnings represent the average for such employees in the economy (OECD 2002b). Individuals earning the APW wage form the middle-income group. Earnings of two thirds of the APW income (0.67 times APW) describe the low-income level, and individuals with 1.67 times the APW earnings form the high-income group. The wage income of women was adjusted according to their lower supply of paid work. The APW-based income was multiplied by the share of female supply of paid work in each country out of that by men.

Income taxes at these income levels and the social security payments by the employee and the employer in each country have been subtracted from the gross earnings to arrive at the net hourly rates, which have then been used in the incentive calculations. Net pensions have been determined by netting pension benefits of taxes and social security payments if levied on pension income in the country in question, and the yearly accrual of pensions have been taken into account. The United States Social Security Administration provides information of social security systems worldwide, and the

pension accrual figures for each country have been obtained from the statistics service of the (SSA 1999). OECD documents the tax systems of its member countries, and its yearly *Taxing Wages* publication has been an important source in modelling the tax systems of the six countries (OECD 2002b). The standard rates of consumption taxes according to the European Commission (2002) were also applied in calculating the total tax wedges incurred. Of deductions from taxable income and tax credits available in each country, those applicable to everyone in each income bracket have been included in the modelling. Appendix 3 presents the tax treatment applied in the Finnish case. The format is similar to that of OECD (2002b) in its *Taxing Wages* report.

In the incentive calculations only the public or the most prevalent pension system in each country has been considered. For countries where private retirement insurance or occupational programs are common this is a source of bias. However, accounting for these alternative retirement income sources is not possible within the scope of this work. The characteristics of the pension systems have been taken into account as precisely as possible for a single person in the three income classes. The method is similar to that applied by Gruber rand Wise (1999), for example, who have worked extensively on social security systems and retirement incentives. Accounting for the value of household work is one way in which this work differs from their approach. Also the effect of social security payments made by the employer on wages are included, and assumed here to lower them.

5.4 Option value

In many countries, the public pension scheme is constructed to reward an individual postponing the decision to retire until or beyond the official retirement age. This is the case in Finland, for example, where accrual rate of pension benefits is much higher during final years before the legal retirement age than earlier. It is thus not only relevant to consider whether to retire this or next year, which is the assumption in the NRR calculation, but also to extend the consideration further along in order to benefit from the enhanced accruals. Similar to the net replacement rate calculations, the option values have been calculated taking the viewpoint of a 55-year-old. Retiring at each successive year is compared to retiring at 55 in terms of lifetime utility. Life expectancy, as well as

the effect of the age of retirement on the pension income is considered. Thus, postponing the retirement may not be worthwhile even if the pension system rewarded delayed retirement with higher benefits if the years left to enjoy the higher pension are short. Also, retiring before the official pension age may yield a pension income lower than one received after the official age by a difference not completely offset by more household work after retirement. Tax treatments and income levels applied in the option value calculations have been the same as in the calculation of NRR.

The concept of utility is essential in understanding the option value, as it was with considering household work in relation to the financial incentives to retire. Individuals' utility is represented by income, both in money terms as wage and pension, and in terms of the value assigned to household work. Based on the option value model by *James H. Stock* and *David A. Wise* (1990: 1159), the expected lifetime utility at time *t* of an individual retiring at age *a* $(V_t(a))$ can be expressed in general form as follows:

$$V_t(a) = \sum_{s=t}^{a-1} (1+\tau)^{-(s-\tau)} u(Y) + \sum_{s=a}^{T} (1+\tau)^{-(s-\tau)} PW \qquad (11)$$

$u(Y)$ is the period-specific utility when still in paid work, *Y* being the wage income. It is summed over the years of employment from time *t* until the time period preceding retirement *a-1*. τ is the discount factor applied in order to express the value of future income today, and *s* gives the number of years the person is expected to work between *t* and *a-1*. So $\sum_{s=t}^{a-1} (1+\tau)^{-(s-\tau)} u(Y)$ represents the part of lifetime utility accrued during working life left. The second term in the equation is the periodic utility after retirement, from the age of retirement *a* to the expected age of death *T*. Again, the discount factor τ is applied in order to express the income in net present value. PW is defined as

$$PW \equiv u\left[kP(a, Y_{r-1})_i\right] \qquad (12)$$

and is in principle identical to the numerator in the equation for the net replacement rate. $P(a, Y_{r-1})_i$ equals the level of pension available at age *i* when retiring occurs at age

a, depending on the wage (Y_{r-1}) . The factor k in front of the pension term expresses the relationship between pension benefits and the wage. A value of *k* greater than one would imply added utility from retiring and a disutility from continuing work, and a *k* less than one the opposite. Since we are accounting for the value of household work by adding the term D_{ret} , and by allowing it to differ across the employment statuses, *k* is assumed equal unity and can be ignored:

$$u\left[kP(a,Y_{r-1})\right] = u\left[P(a,Y_{r-1}) + D_{ret}\right] \qquad (13)$$

As defined in Stock and Wise (1990), the option value for retirement is the difference between the expected lifetime utility if the individual postpones his decision to retire to the optimal retirement age and the expected utility if he retires today. There are costs involved in both alternatives: A cost for postponing retirement from the forgone household work, and a cost for retiring immediately from losing additional years' income and possibly higher pension accrual. The option value at time *t* is

$$OV_t = \left[V(a^*)\right] - V_t(t) \qquad (14)$$

where $V(a^*)$ is the lifetime utility when the individual retires at age a^* and *V(t)* the utility if retiring at current time *t*. The asterisk above the age refers the property of the option value equation that allows for solving for the optimal retirement age a^*. This occurs at the age where the option value reaches zero. A peak, or the highest value, in the option value observed occurs at the age until which the incentive to keep working increases. After this, while still positive, the decreasing option value tells us that the benefit from working an extra year is losing ground to the advantage from starting to enjoy the pension benefits accrued.

Option value is an established measure of the incentive to retire, and is employed for example in *Social Security and Retirement around the World* edited by Gruber and Wise (1999). They emphasize the same underlying conditions that have prompted this work: analyses of social security provisions and labour force participation of the ageing

contribute to the understanding and overcoming the challenges presented by the demographic ageing and falling labour force participation (Gruber and Wise 1999: 1). Börsch-Supan (1998) examines the incentive effects of social security systems on retirement behaviour in Germany and across Europe, and finds that the option value is a significant factor in predicting individuals' retirement behaviour. The lower the option value, the more likely a person is to retire (Börsch-Supan 1998: 31).

6. RESULTS

6.1. Time use of the employed and the non-employed

First, to support the hypothesis that housework supply increases in non-employment, which justifies the inclusion of the value of household work to the incentive calculations for retirement, the place of activity of the employed and the non-employed was examined at each hour of the day. A person was categorized as employed if he or she had reported paid employment as his/her main activity in the survey, and supplied a positive amount of paid work. The non-employed include individuals who because of unemployment, retirement, or some other reason were not participating in the labour force.

In the Finnish time-use diaries, the respondents have reported their location along with the activity they were engaged in. For other countries I have constructed the locations based on the activities in the main time use categories: "at home", "at work", "elsewhere", and "travel". Of course, not all household work takes place at home, nor is all paid work done at the workplace. Examination of activity locations reveals the opportunity of engaging in various kinds of activities and gives an idea of the mobility of individuals in space-time, however. I have separated travel as a place of its own because it represents movement in both space and time and hence change in vertical and horizontal position in space-time, while the other activity places only involve movement in time, i.e. vertical movement along the activity trajectory.

It could be expected that people who do not work have more free time for hobbies and other leisure activities, and that they would not be bound to their homes and workplaces

during the day. This would be seen as higher proportions of the non-employed reporting their location to be "elsewhere" and hence also "travel" would be a more common location. On the other hand, if the non-employed were expected to allocate the time freed from paid work toward household work, they would spend more time "at home" and less elsewhere and travelling. Naturally, they were not expected to spend any time "at work". Figure 4 presents the percentages of the 45 to 64 –year-olds in Denmark, Finland, and the UK whose place of activity is "at home" at each hour. The solid lines stand for the employed, and the dashed lines represent the non-employed. The lines for the non-employed lie above the lines for the employed throughout the day in the three countries. This can be taken self-evident but figure 5, which shows the percentages of individuals with the place of activity "elsewhere", makes the point. "Elsewhere" refers to places other than "home", "workplace", or "travel", and expresses the opportunity for activities like attending events or participating hobbies and organized activities. The difference between the employed and the non-employed is noticeably smaller than in the case of location "at home".

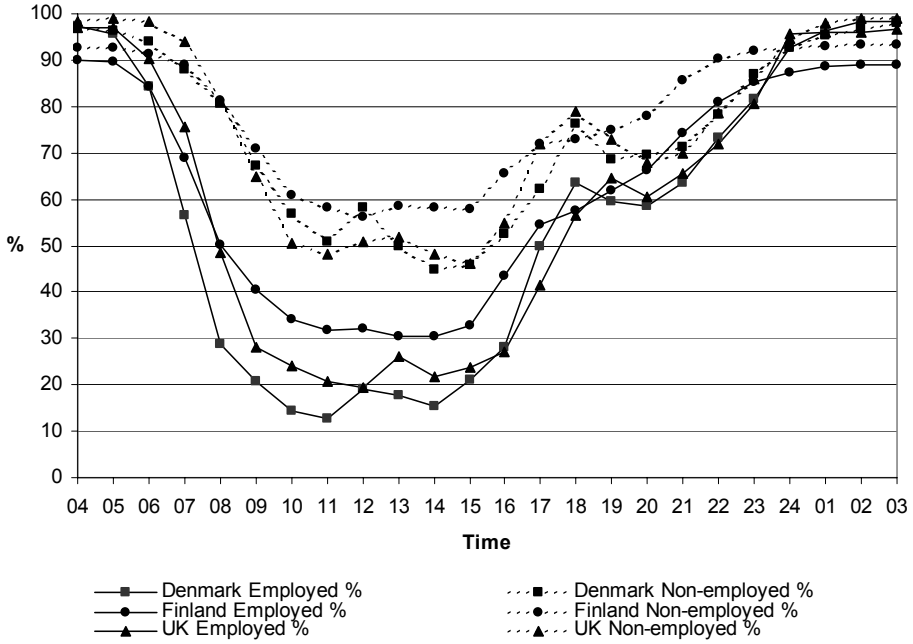

Figure 4. Percentage of individuals aged 45-64 "at home" each hour.

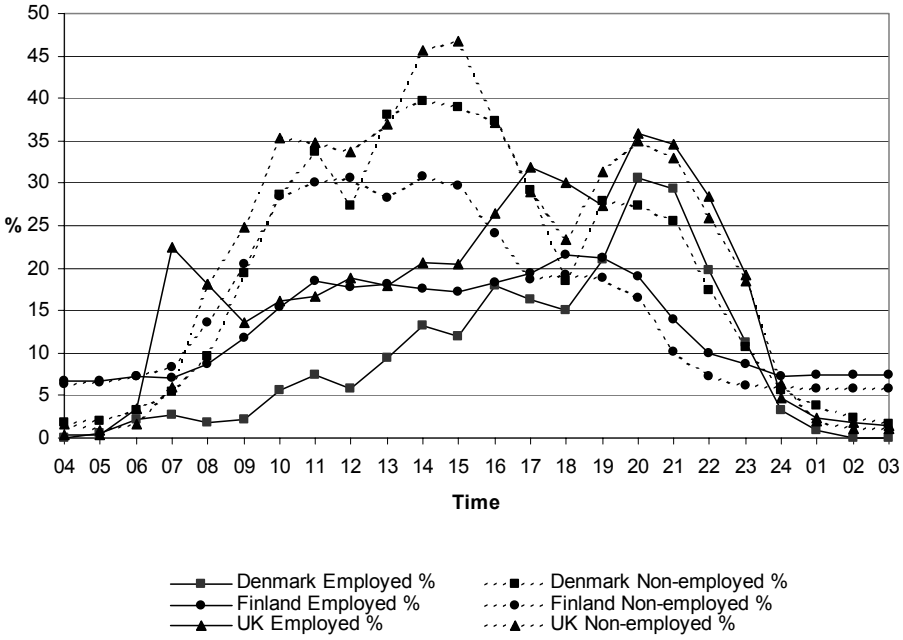

Figure 5. Percentage of individuals "elsewhere" each hour.

While the value of each graph tells the percentage of individuals located at the particular place each hour, the area under the curve can be considered the aggregate time spent at that location. It is clear that the non-employed allocate most of the time freed from the workplace towards the home. At any given time, more than 45% of the non-employed persons in the samples are at home, while the area under the graph for the category "elsewhere" is not considerably larger than for the employed although it is shaped differently for the employed and the non-employed. This observation does not imply that the non-employed spend all the of time at home in household work, but it clearly indicates that hey have the opportunity to devote more time to taking care of their homes and other household members than do the employed. It is also noteworthy, that after the regular working hours the employed surpass the non-employed in the participation rate in activities taking place "elsewhere". Thus the difference between the two groups is mainly in the time of the day when these activities are performed, not in the time used in them while there is a clearer absolute difference in the time spent "at home". There are differences between the countries, but the relevant comparison here is

between the employed and the non-employed within each country due to the different constructions of these variables.

6.2. Household work

Taking a closer look at the time use of individuals confirms that the non-employed spend more time in household work than the employed. Table 6 includes the weekly hours spent in household work by men and women in different countries by employment status. Also the female shares of the total supply of household work are presented. In all countries, the hours of household work are longer for the non-employed than for the employed. The difference is on average 9 hours, but notable differences exist between the countries. Moreover, the absolute time spent in household work varies a great deal in the eight countries. Denmark and Portugal have the smallest supply of household work for men, while the British and German men perform the most household work. Denmark has the smallest figures for women as well, but he Portuguese women have by far the longest hours of household work per week.

Table 6. Household work (hours per week) and female share of domestic work by country.

	Men		Women		Female share	
	Employed	**Non-Employed**	**Employed**	**Non-employed**	**Employed**	**Non-employed**
Denmark	3.41	9.92	9.84	16.21	0.74	0.62
Finland	14.03	22.33	23.49	33.35	0.63	0.60
Austria	11.88	21.84	27.61	34.88	0.70	0.61
Belgium	14.42	23.45	17.48	37.63	0.55	0.62
Germany	20.12	24.10	24.69	27.25	0.55	0.53
Netherlands	11.72	25.15	26.66	35.62	0.69	0.59
United Kingdom	13.70	26.77	22.55	31.78	0.62	0.54
Portugal	6.30	14.93	27.65	41.77	0.81	0.74
Average	13.17	22.65	24.30	34.61	0.65	0.60

With the exception of Belgium, household work is shared more equally between men and women among the non-employed than the employed. It is surprising that the female shares of household work are noticeably low in the Continental regime countries,

especially in Germany and Belgium. This contradicts the expectation based on the welfare regime typology that the gender roles in the Continental regimes are more traditional, and household work is principally performed by women. Possible explanations include using hired help in household work more often in these countries than in the Scandinavia, for example, and some kind of bias in the data. Household work includes the same activities in all countries, but instructions on reporting the activities or dealing with simultaneous activities may have differed across surveys.

Comparing these results to Table 7, where the household work hours and female shares have been calculated by grouping the countries into the welfare regimes, the Continental regime still exhibits the most equal gender allocation of household work. In all regimes the female share are lower and closer to 0.5 for the non-employed than the employed. The difference in the supply of household work between the employment statuses is the smallest in the Nordic regime for both men and women. Women adjust their household work supply by less than men with respect to employment status in the Nordic and the British regimes, while the difference is bigger for women the in the Continental and Peripheral regimes. The female share of household work is by far the highest in the Peripheral regime

Table 7. Household work (hours per week) and female share of domestic work by welfare regime.

	Men		Women		Female Share	
	Employed	**Non-employed**	**Employed**	**Non-employed**	**Employed**	**Non-employed**
Social Democratic/ Scandinavian	12.11	17.86	21.75	27.04	0.64	0.60
Conservative/ Continental	16.67	23.08	25.49	33.32	0.60	0.59
Peripheral (Portugal)	6.30	14.93	27.65	41.77	0.81	0.74
Liberal/British (UK)	13.70	26.77	22.55	31.78	0.62	0.54

6.3. Paid work

Table 8 presents the weekly hours of paid work among the employed as well as the female shares of paid work by country, and Table 9 shows the same by regime. Men supply about ten hours more paid work per week than women do. In the Nordic regime paid work is shared most equally between men and women, while in the Continental regime the female share of paid work is the lowest. Of individual countries however, Belgium shows exactly equal allocation of paid work, and for Germany the female share is 0.45. Netherlands and Austria of the same regime exhibit the most unequal allocation of paid work. This corresponds to the low female shares of household work in Belgium and Germany and high shares in other Continental countries.

Table 8. Weekly hours of paid work among the employed 45–64 –year-olds.

	Men	Women	Female share
Denmark	35.18	28.28	0.45
Finland	38.62	30.85	0.44
Austria	35.60	20.54	0.37
Belgium	48.02	47.48	0.50
Germany	24.62	20.29	0.45
Netherlands	42.59	24.46	0.36
United Kingdom	47.09	35.08	0.43
Portugal	44.92	35.82	0.44
Average	40.21	30.64	0.43

Table 9. Weekly hours of paid work and female shares of paid work among the employed by welfare regime.

	Men	Women	Female share
Social Democratic/ Scandinavian	37.99	30.52	0.45
Conservative/ Continental	29.81	20.67	0.41
Peripheral (Portugal)	44.92	35.82	0.44
Liberal/British (UK)	47.09	35.08	0.43

The hours of paid work are calculated for the employed only. Obviously, if considering the average hours of work of all individuals in the sample they would be shorter. Table 10 below includes the participation rates of women in paid work in five of the samples. The definition of working is that the individual reports paid employment as her activity and/or reports a positive number of work hours. The countries chosen here are those for which the participation rates could be calculated in a comparable manner.

Table 10. Female participation rates in paid work in the samples of 45–64 –year-olds.

Denmark	0.35
Finland	0.69
Austria	0.28
Germany	0.78
Netherlands	0.61
UK	0.50

The German and Finnish samples have the highest female participation rates. High participation in Finland is consistent with Kosonen's results in his classification of the welfare regimes (1995: 33). However, Denmark only has a female participation of 35%, which disagrees with the expected high rates in the Nordic regime. Germany has a very high participation rate, and the Netherlands follow with 61%. Of these samples, only Austria fits the low female labour participation in the Continental regime observed by Kosonen. The average participation across the countries is 53% for women and 60% for men. Of course, these samples only include individuals between the ages 45 and 64, who are not likely to be absent from the workforce due to childcare responsibilities, for example. On the other hand, the oldest individuals may already have entered some form of early retirement.

6.4. Total work

Tables 11 and 12 complete the picture of time use by presenting the weekly hours of total work, paid work and household work combined, by country and welfare regime, respectively. When both kinds of work are considered, the gender allocation of work is not more equal among the non-employed as was the case with household work alone.

Women seem to perform a clear majority of total work in the Peripheral regime, while there are no large differences between the other regimes. There are pronounced differences between individual countries, however. Germany has a lower paid work supply than the other Continental countries, and more equal gender allocation of work. Finland stands out with the most equal distribution of total work both with respect to gender and to the employment status.

I have tested for the statistical significance of the observed differences in the average time use in paid and household with a t-test. Both gender and employment status as classifying variables yield statistically significant differences in the mean weekly hours. This is true for all countries and both paid and household work, except for paid work in Germany. The tests were not performed on Belgium and Portugal whose results do not come from raw data, and the summary statistics other than the means are not known. However, in Belgium's case the allocation of work seems to be very similar to that of Germany, while in Portugal the differences between men and women as well as between the employed and the non-employed are pronounced.

Table 11. Total work (hours per week) and female shares by gender and country.

	Men		Women		Female share	
	Employed	**Non-employed**	**Employed**	**Non-employed**	**Employed**	**Non-employed**
Denmark	38.59	15.23	38.13	18.76	0.50	0.55
Finland	52.65	23.64	54.33	33.89	0.51	0.59
Austria	47.48	23.46	48.15	35.69	0.50	0.60
Belgium	48.02		47.48		0.50	
Germany	44.74	33.20	44.97	39.64	0.50	0.54
Netherlands	54.31	27.49	51.11	36.09	0.48	0.57
United Kingdom	60.79	30.17	57.63	33.99	0.49	0.53
Portugal	51.22	15.51	63.47	42.69	0.55	0.73
Average	51.31	25.58	52.45	37.00	0.50	0.59

Table 12. Total work (hours per week) and female shares of total work by gender and welfare regime.

	Men		Women		Female Share	
	Employed	**Non-employed**	**Employed**	**Non-employed**	**Employed**	**Non-employed**
Social Democratic/ Nordic	50.10	20.61	52.27	28.32	0.51	0.58
Conservative/ Continental	46.48	27.43	46.15	36.61	0.50	0.57
Peripheral (Portugal)	51.22	15.51	63.47	42.69	0.55	0.73
Liberal/British (UK)	60.79	30.17	57.63	33.99	0.49	0.53
Average	52.15	23.43	54.88	35.40	0.51	0.60

6.5. Measures of dissimilarity between countries

I approach the question whether the allocation of working time between the workplace and home is affected by the authority constraint by examining the level of dissimilarity between the countries. A measure of dissimilarity between pairs of countries with respect to the time use pattern they represent is used to capture their similarity or dissimilarity to each other[1]. The measure is based on the Euclidean Distance, which describes the distance between to vector points in metric space (Chiang 1984: 73). A similar method has been applied to examining differences in time use by Szalai (1972) and Harvey (1989). The measures of dissimilarity in Table 13 are the square roots of squared differences in the mean weekly hours of paid and household work by employed men and women in pair of countries. First, the hours of paid work by men in one country is subtracted from the hours in another. Then the same is repeated for women, and household work for both men and women, and for all country pairs. The smaller the measure, the more similarity there is between the pair of countries. Respectively, a higher value indicates more dissimilarity. The matrix resembles a correlation matrix in the sense that each country is compared to every other country, and that the measure of dissimilarity provides information on the relationship between the two.

There are differences between the countries, as was seen in the previous section. Since four time use factors are included (paid work by men, paid work by women, household work by men, and household work by women), the measure expresses the overall dissimilarity instead of differences in just one time use category at a time, which is the case with tables in the previous section. If the welfare regime typology were an appropriate classification of these countries with respect to time use in paid and household work, the countries that belong to the same regime should get a low value when compared to other countries in the regime.

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[1] Here $D = \sqrt{\sum_{i=1}^{k} (a_1 - a_2)^2}$, Szalai and Converse applied the measure to the proportions of different time use categories out of total time (Szalai 1972: 142).

Table 13. Measures of dissimilarity (D) between pairs of countries in weekly hours of paid and household work by employed men and women.

	DEN	FIN	AUT	BEL	GER	NL	UK	POR
DEN	0.00							
FIN	17.82	0.00						
AUT	21.15	11.70	0.00					
BEL	26.70	20.03	31.45	0.00				
GER	25.99	18.60	14.04	37.04	0.00			
NL	20.52	8.48	8.07	25.52	20.37	0.00		
UK	21.34	9.53	19.30	13.45	27.75	12.41	0.00	
POR	21.84	11.90	18.74	17.75	29.21	12.84	9.28	0.00

When Denmark is compared to the other countries, we first notice that the measure gets very high values. The country has the most similarity to Finland, which is in accordance with the welfare regime typology. Finland, however, has more similarity to the Netherlands and the UK than Denmark. Remembering the differences between Denmark and Finland, especially in time use in household work, this result is not surprising. Finland and Denmark do not seem to fall into the same time use category according to the data. Both countries differ the most from Belgium.

Of the continental countries, Austria, Germany and the Netherlands get a dissimilarity measure indicating that they have the most in common with other countries in the Continental regime, even so that all three get the lowest score when compared to one of the other two. All three have the highest value when compared to Belgium, which in turn has the most in common with the UK and least with Germany. Continental regime seems to contain countries with similar time use patterns, but there are large differences within the regime. The measure of dissimilarity thus confirms the conflicting observations made in the previous section.

The United Kingdom has the least dissimilarity to Portugal, and the second most similar country to the UK is Finland while it has the least in common with Germany. Finland has the lowest value with UK, and Germany gets the second highest. A second look at tables 8, 9, and 10 confirm that time use in household work and the total work hours,

especially for women, are similar in the two countries, so the observed similarity between Finland and the UK is confirmed by the measure of dissimilarity.

Portugal gets the smallest measure of dissimilarity with the UK and the highest with Germany. Somewhat surprisingly the UK and Portugal are thus the best match in this comparison: they both are the most similar to each other and also the most dissimilar to Germany. Furthermore, the second lowest measure for both comes from comparison to Finland. The overall picture this exercise gives seems to tell that time use patterns do not follow the welfare regime typology very well, but that there seems to be two groups of countries exhibiting mutual similarity: That of Austria, Germany, and the Netherlands on one hand and the UK, Portugal, and perhaps Finland, on the other. Finland also shows some similarity to the Netherlands and Denmark. Denmark and Belgium are very different from the other countries as they receive high measures with all countries, although Denmark gets its lowest dissimilarity measure when compared to the other Nordic country.

I expected the UK and Portugal to have the highest measures of dissimilarity overall, since they are the only countries in their regimes represented here. Portugal because no data is available from other countries of the Peripheral regime, and the UK because Kosonen assigns it to a regime of its own in Europe. The UK and Portugal do not receive the highest values, however. The average measure of dissimilarity to the other countries for Denmark is 22.2 and 21.75 for Belgium, while for the UK and Portugal the averages are 17.30 and 18.71, respectively.

6.6. Net replacement rates

Household work has two opposing effects on NRR: the value of household work when retired works to increase the net replacement rate because in the numerator while household work when still employed increases the denominator and thus decreases the NRR. Since in all countries, irrespective of gender, there is some addition to domestic work after withdrawal from work the overall effect is to amend the NRR.

Tables 14 and 15 show the average net replacement rates across the three income levels in seven countries for individuals whose age during their last year of work is from 55 to 70. The first column for each country shows the net replacement rate with household work included, while in the second column it is omitted. In every case, the net replacement rates are higher when household work is accounted for. This implies that retirement is, in fact, more attractive to a 55-year-old or older individual than what incentive measures with only paid work as source of income suggest. It is noteworthy that with household work, the net replacement rates for women are greater than one in Belgium, Finland, and Portugal at all ages above 55, and become greater than one also for men in some cases. A replacement rate greater than one implies that retiring at that age would actually be financially more beneficial than continuing to work. The net replacement rates become grater than one also in the column without household work in countries where there is no ceiling for pension income in the public pension scheme. In practise this hardly is the case; not all characteristics of the pension systems have been captured here. The main finding is that household work increases the net replacement rate in all cases, and thus makes the incentive to retire stronger.

Table 14. The average net replacement rates across countries for men.

Last year of work	Belgium		Denmark		Finland		Germany		Netherlands		Portugal		UK	
	incl.	**excl.**	**incl.**	**excl.**	**incl.**	**excl.**	**incl.**	**excl.**	**incl.**	**excl.**	**incl.**	**excl.**	**incl.**	**excl.**
55	0.94	0.75	0.72	0.48	0.93	0.40	0.71	0.52	0.86	0.44	0.97	0.79	0.58	0.23
56	0.94	0.75	0.77	0.48	0.95	0.44	0.77	0.62	0.87	0.44	0.99	0.82	0.58	0.23
57	0.94	0.75	0.77	0.48	0.97	0.47	0.79	0.64	0.87	0.45	1.01	0.84	0.59	0.24
58	0.94	0.75	0.77	0.48	0.99	0.51	0.81	0.66	0.87	0.45	1.04	0.87	0.59	0.25
59	0.94	0.75	0.77	0.48	1.02	0.54	0.82	0.69	0.87	0.45	1.06	0.89	0.60	0.25
60	0.94	0.75	0.77	0.48	1.04	0.58	0.84	0.71	0.88	0.46	1.08	0.92	0.60	0.26
61	0.94	0.75	0.77	0.48	1.06	0.61	0.86	0.74	0.88	0.46	1.11	0.95	0.61	0.26
62	0.94	0.75	0.77	0.48	1.08	0.65	0.88	0.77	0.88	0.46	1.13	0.97	0.61	0.27
63	0.94	0.75	0.77	0.48	1.16	0.78	0.90	0.80	0.88	0.46	1.15	1.00	0.62	0.27
64	0.94	0.75	0.77	0.48	1.20	0.85	0.92	0.82	0.89	0.47	1.18	1.03	0.62	0.28
65	0.94	0.75	0.85	0.58	1.24	0.91	0.94	0.86	0.89	0.47	1.20	1.05	0.94	0.68
66	0.94	0.75	0.85	0.58	1.28	0.97	0.97	0.91	0.89	0.47	1.20	1.05	0.94	0.68
67	0.94	0.75	0.85	0.58	1.31	1.03	1.01	0.96	0.89	0.47	1.20	1.05	0.95	0.69
68	0.94	0.75	0.85	0.58	1.35	1.09	1.05	1.02	0.89	0.47	1.20	1.05	0.95	0.70
69	0.94	0.75	0.85	0.58	1.39	1.16	1.09	1.08	0.89	0.47	1.20	1.05	0.96	0.70
70	0.94	0.75	0.86	0.59	1.40	1.17	1.14	1.15	0.89	0.47	1.20	1.05	0.96	0.71

incl. = household work included, **excl.** = household work excluded

Table 15. The average net replacement rates across countries for women.

Last year of work	Belgium		Denmark		Finland		Germany		Netherlands		Portugal		UK	
	incl.	**excl.**	**incl.**	**excl.**	**incl.**	**excl.**	**incl.**	**excl.**	**incl.**	**excl.**	**incl.**	**excl.**	**incl.**	**excl.**
55	1.24	0.87	0.87	0.57	1.04	0.36	0.74	0.54	0.87	0.40	1.03	0.77	0.60	0.22
56	1.24	0.87	0.87	0.57	1.06	0.39	0.80	0.64	0.87	0.40	1.04	0.80	0.60	0.22
57	1.24	0.87	0.87	0.57	1.07	0.42	0.82	0.66	0.87	0.40	1.06	0.83	0.60	0.23
58	1.24	0.87	0.87	0.57	1.09	0.46	0.83	0.68	0.87	0.40	1.08	0.85	0.61	0.23
59	1.24	0.87	0.87	0.57	1.10	0.49	0.85	0.71	0.87	0.40	1.10	0.88	0.61	0.24
60	1.24	0.87	0.87	0.57	1.11	0.52	0.86	0.74	0.87	0.40	1.12	0.90	0.61	0.25
61	1.24	0.87	0.87	0.57	1.13	0.55	0.88	0.76	0.87	0.40	1.14	0.93	0.92	0.62
62	1.24	0.87	0.87	0.57	1.14	0.58	0.90	0.79	0.87	0.40	1.15	0.95	0.92	0.62
63	1.24	0.87	0.87	0.57	1.20	0.71	0.92	0.82	0.87	0.40	1.17	0.98	0.92	0.63
64	1.24	0.87	0.87	0.57	1.22	0.76	0.94	0.85	0.87	0.40	1.19	1.01	0.93	0.63
65	1.24	0.87	0.94	0.69	1.24	0.82	0.96	0.89	0.87	0.40	1.21	1.03	0.93	0.72
66	1.24	0.87	0.94	0.69	1.27	0.87	0.99	0.94	0.87	0.40	1.21	1.03	0.94	0.73
67	1.24	0.87	0.95	0.70	1.29	0.93	1.03	0.99	0.87	0.40	1.21	1.03	0.94	0.73
68	1.24	0.87	0.95	0.70	1.32	0.99	1.07	1.05	0.87	0.40	1.21	1.03	0.94	0.74
69	1.24	0.87	0.95	0.70	1.34	1.04	1.11	1.12	0.87	0.40	1.21	1.03	0.95	0.74
70	1.24	0.87	0.70	0.55	1.35	1.06	1.15	1.18	0.87	0.40	1.21	1.03	0.95	0.75

incl. = household work included, **excl.** = household work excluded

6.7. Option values for retirement

The results of the option value calculations are presented below in graphs illustrating the difference in life-time earnings in the two alternatives a 55-year-old individual is considering: Whether to retire now or to postpone retirement until each successive year (Figures 6–12). When looking at the graphs we should keep in mind this setting. The individual is expected to maintain the same real income level by setting the growth rate of wages and the discount rate of future income equal. Thus, the thousands of euros in the graphs represent the net present values of the difference in life earnings at each future age. Accounting for household work in the option value calculations has two effects. First, the income from work before the pensionable age is relatively lower due to the increase in household work in retirement and second, for the same reason, the benefit from postponing retirement decreases as household work is considered. The option value is thus lower when household work is accounted for, and household work therefore encourages early retirement.

We do not always observe an optimal age for retirement before the age 68 in Figures 6–12. This would occur at the intersection of the graph and the horizontal axis where the option value equals zero. The value of x-axis at the intersection expresses the age where all the benefit from postponing the retirement decision one more year as opposed to losing a year of retirement benefit has been depleted. Nor do we find a peak in the option value in all cases, which means that in the countries where the option value keeps increasing or flattens out without starting to decline, the pension scheme exhibits a design that encourages working indefinitely.

Where a peak in the option value is observed, the slope of the graph is steeper after the age in question when household work is included in the calculation. The attractiveness of staying at work diminishes at a faster rate than in the case where household work is omitted. In addition the option value is lower to begin with. The option value graphs for each country are presented below with description of the pension systems in order to clarify the results.

Belgium

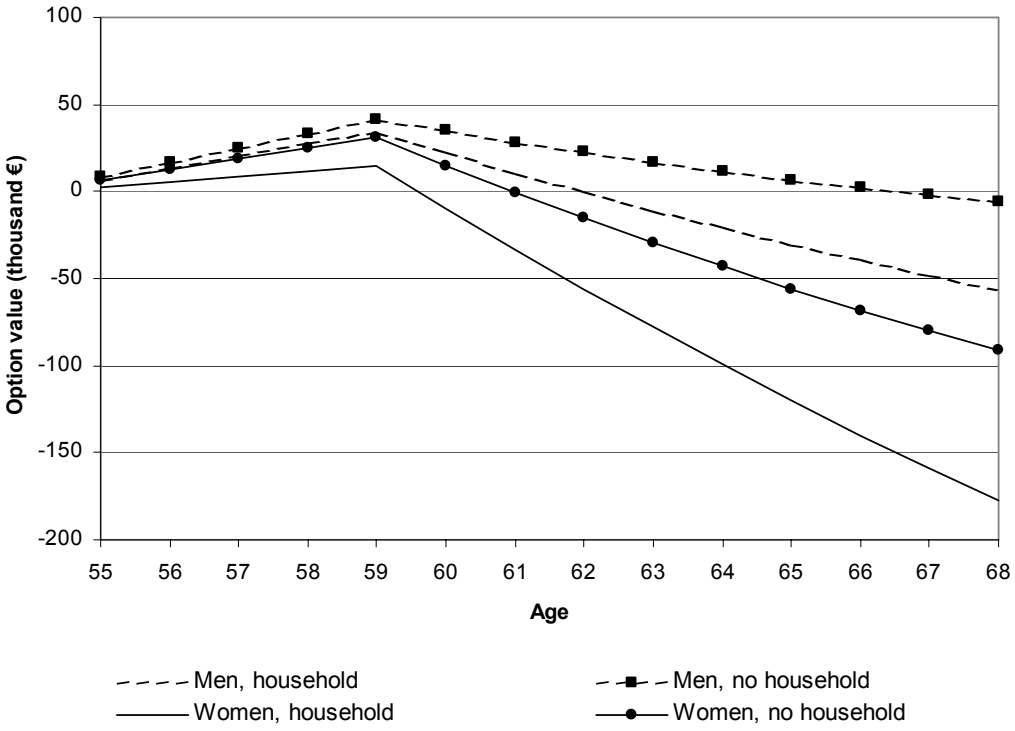

Figure 6. Option values at age 55 in Belgium, average earnings. Option value expresses the difference in lifetime earnings in thousands of Euros for each age between two alternatives: if the person retires at 55 or at each successive age.

The option values for each year after the age 55 are graphed in Figure 6 for an individual with income equal to the average of the three levels considered (0.67APW, APW, and 1,67APW) in Belgium. For both men and women the option values with household work are lower than the option values based on income from wages and pension alone. Also the option values decrease faster after the peak value with household work. Optima for the decision to retire are observed for both men and women, at the ages of 60 and 62, respectively, with household work. The omission of household work yields a higher optimal age but does not radically change the incentive picture. The differences are bigger for women whose supply of household work is in Belgium larger than that of men by the biggest difference of all the countries studied. The full public old age pension in Belgium provides 60% of average lifetime earnings with a minimum pension guaranteed for low-income pensioners as well as a maximum

employment income for receiving public pension benefits. The retirement age and the minimum length of working career with contributions to the pension scheme are gradually being shifted up to the age of 65 and a 45-year-career but there remains a possibility for earlier retirement at age 60 (SSA 1999).

Denmark

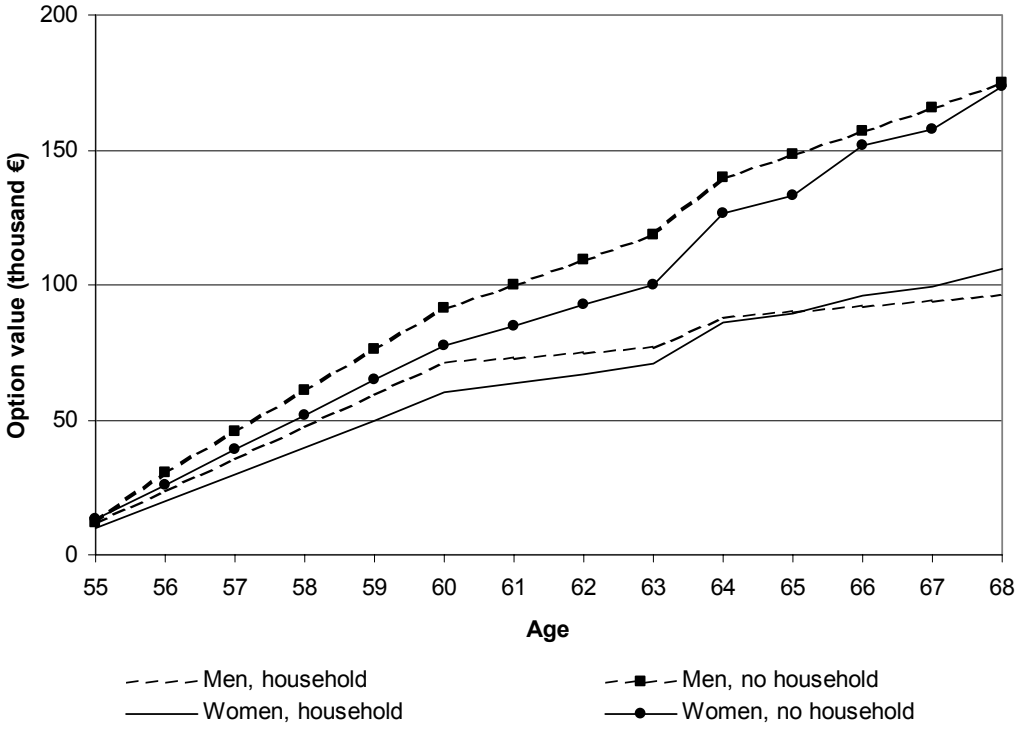

Figure 7. Option Values at age 55 in Denmark, average earnings.

The official retirement age in Denmark is 65 although early retirement plans are available at younger ages (SSA 1999). Here the earliest age when pension benefits can be drawn is set at 61. The public pension scheme in Denmark is a universal flat-rate system. It favours postponing retirement, which is depicted in Figure 7 where the option values keep increasing despite reaching the retirement age. The average age of withdrawal from the labour force is higher in Denmark than in most other countries included in Table 1: 62,5 for men and 61,5 for women. So the incentive provided by the

pension system seems effective. On the other hand, the net replacement rates are relatively low for Denmark (Tables 14 and 15), especially when household work is not accounted for. This would speak in favour of people being forced to work longer, rather than choosing to do so based on the financial incentives.

The levels of household work for both the employed and non-employed are considerably low in Denmark. This is why including the value of household work has but little effect on the option values. There are almost no differences between men and women in either case of the option value. However, the common finding with respect to household work and the incentive to retire holds also for Denmark: Option values are lower when household work is included in the incentive calculation, and retiring becomes relatively more attractive the longer the decision to retire is postponed.

Finland

We consider here the new Finnish pension system with stricter rules regarding entering retirement through unemployment then before, and pension accrual starting at the age of 18. There are deductions from pension if retirement occurs early and increments to it from postponing the retirement decision. In Figure 8 the option value curves become flatter and the difference between option values with and without household work increases after the age 62. The relative increase in the supply of household work in non-employment is greater for men than for women in Finland, which shows in the shape of the option value curve with household work for men: the slope becomes negative at 62 while that of women keeps increasing although the rate becomes smaller. Although the value of household work is higher in Denmark than in Finland (€ 8.1 per hour and € 7.8 per hour, respectively), the effect of accounting for it is more dramatic in Finland. This is due to the large difference in the absolute amounts of and the increase after withdrawal from work in time spent in household work (Table 7).

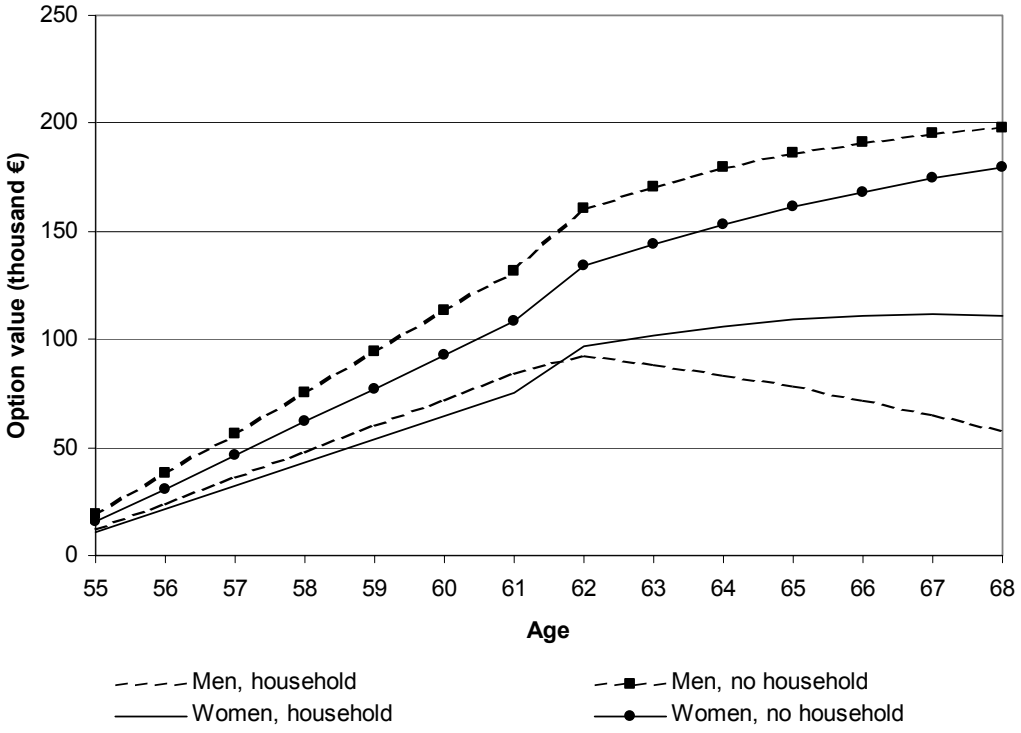

Figure 8. Option values at age 55 in Finland, average earnings.

Germany

In Germany the age of eligibility for public old-age pension depends on the length of the contributory career, and can be 60, 63, or 65 years (SSA 1999). Here the official age is taken to be 65 with the possibility to draw benefits at 63. There are clear penalties from retiring early as well as clear incentives to retire late. The public pension system in Germany targets the replacement rate of 70% of earnings from work. A minimum level of pension income is guaranteed, and there is also a ceiling for public pension benefits.

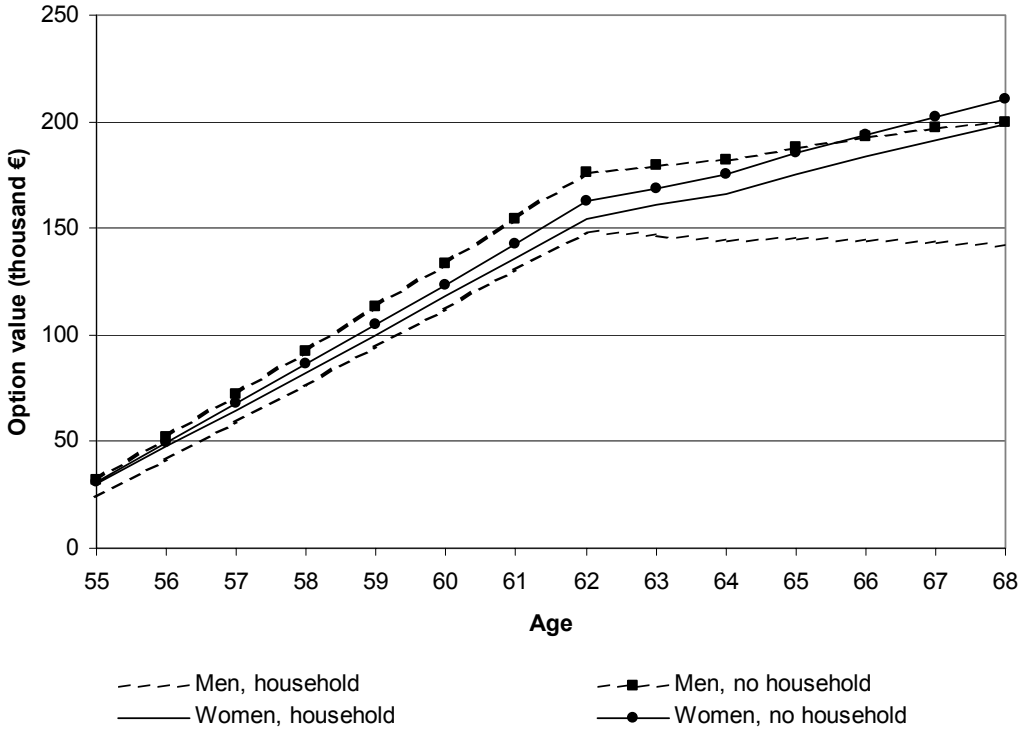

Figure 9. Option values at age 55 in Germany, average earnings.

The option values for Germany differ very little between men and women and between the cases with and without household work as is seen if Figure 9. The option value for men accounting for household work is an exception, which is due to the large difference in the supply of household work between the employed and the non-employed men relative to women (Table 7). Accounting for household work has very little effect on the option value for women. This is due to their relatively stable supply of household work across employment statuses and the quite low wage rate for household work

The Netherlands

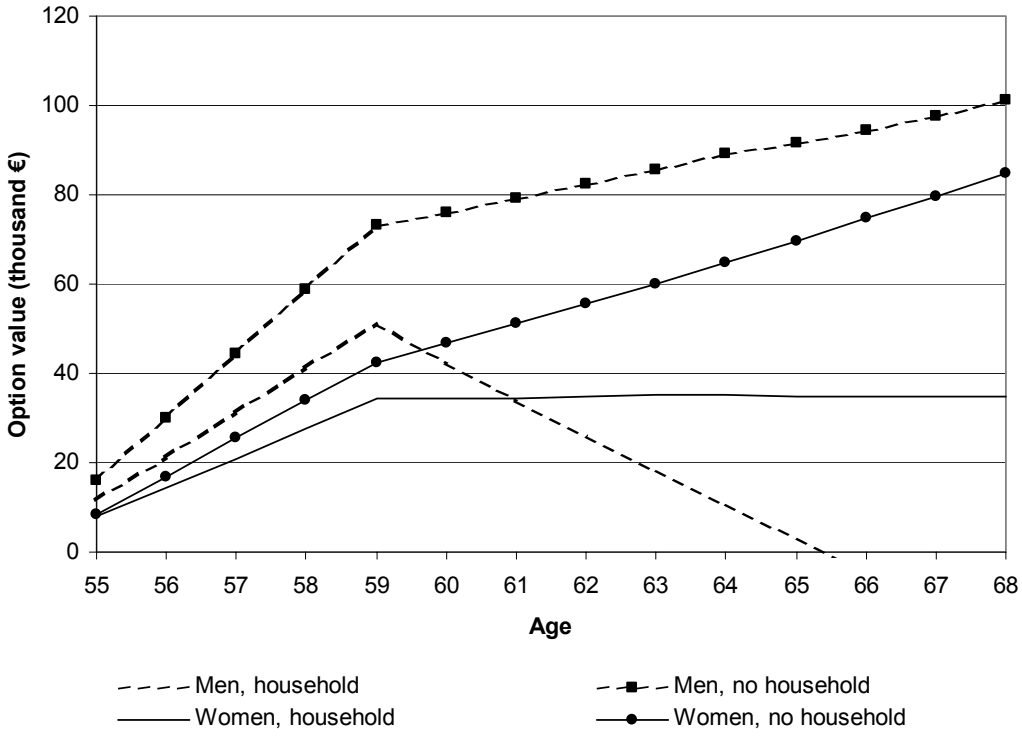

Figure 10. Option values at age 55 in the Netherlands, average earnings.

In the Netherlands there is a flat public pension system, which provides pensioners with about € 530 a month in pension benefits (SSA 1999). For people with higher income, the private occupational pension schemes are the main source of retirement income. These schemes provide pensioners with a replacement rate of 70% if income when employed after a working career of 40 years with contributions to the scheme (OECD 2001 (Ageing and Income)). In these calculations we have assumed that the lowest income group earning 67% of the APW wage only receives the public flat pension while the middle and upper income groups opt for the private occupational schemes and receive 70% of their wage income as pension benefits. Due to the adjustment of women's earnings by their lower supply of labour, women in the APW earnings group

fall into the category receiving the public pension. In Figure 10 the averages of option values obtained with this treatment are presented. We see again that accounting for household work seems to have a larger effect on men's option value than on women's for the same reason as above. With household work included, men actually reach the optimal retirement age shortly after 65, and women's incentives to keep working become flat at 59. The absolute values of the option values seem to be somewhat lower in the Netherlands than in other countries so far. This is due to the assumption that the lowest income group only receives the public pension. For the same reason the net replacement rates in Tables 14 and 15 are low.

Portugal

The value of household work applied for Portugal is by far the lowest among the countries. We should also remember that the time use information for Portugal is not from original data. However, I include the graph for Portugal here to provide perspective to different public welfare systems and as an example of the Southern European countries. Portugal has raised the retirement age for women from 62 to equal to that for men, 65, over the period from 1994 to 1999. In reality early retirement scheme enables retirement at age 62, which is assumed here. The public pension system provides benefits between the minimum of 20% and the maximum of 80% of average monthly earning when employed (SSA 1999).

The net replacement rates are among the highest in Portugal, exceeding unity at age 63 for men and at age 64 for women even without domestic work. In addition, the net replacement rates increase greatly after withdrawal from work. On the other hand, value of household work, 1.5 euros, is very low, as are the APW earnings relative to other countries. This results in very low option values in Figure 11 compared to other countries. The assumption of universal coverage of the workforce by the public pension system, as well as the modelling of the tax treatments of wage earnings and pensions present a potential source of error resulting in this contradiction between the two measures of retirement incentive. The overall result based on the option values is that individual has an incentive to continue working throughout the time period considered. While the option values are noticeably low, the same is true for Portugal as is for all

other countries: Accounting for household work decreases the option values. These findings fit well with the average late withdrawal from work at 66 years of age (Table 1). The value of household work applied here is the mandatory minimum wage for domestic services, which may be lower than actual wages paid to domestic help (Fontainha 2003). The graphs for men and women seem surprisingly similar, given the unequal allocation of household work between the sexes. The low wage rate for household work does not amplify the differences in the absolute amounts of household work supplied as much as a higher rate would, and men do a larger share of household work when no longer employed.

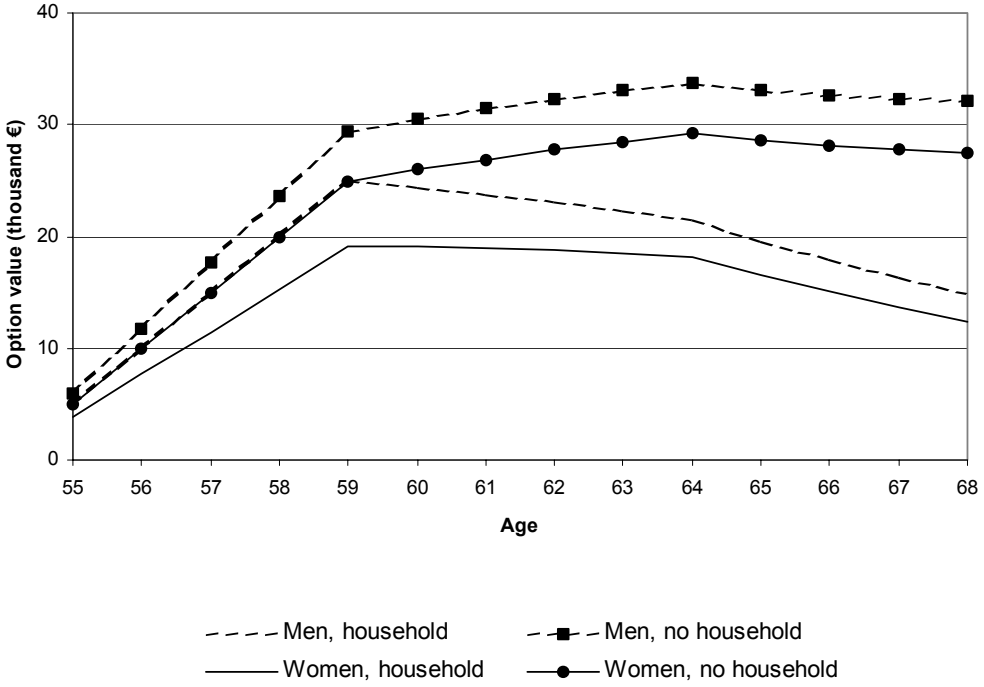

Figure 11. Average option values at age 55 in Portugal, average earnings.

The United Kingdom

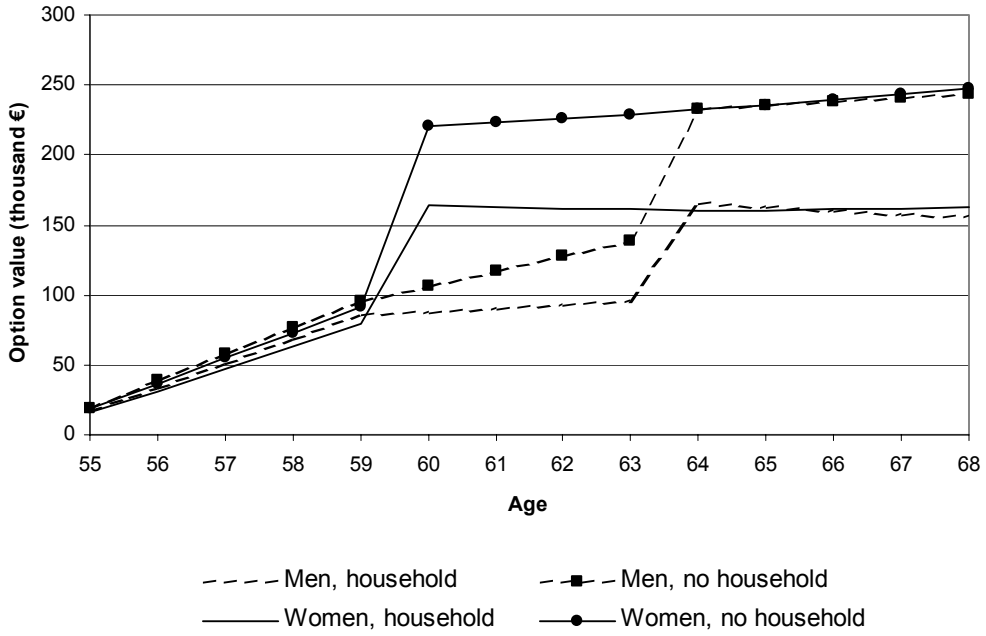

Figure 12. Option values at age 55 in the United Kingdom, average earnings.

In the UK, we are only considering the State Earnings Related Pension Scheme (SERPS), by which about 25% of the labour force is covered, while private pension schemes constitute over half of total income in retirement in the UK (Gruber and Wise 1999: 415). SERPS is currently going through a remodelling, where the original target replacement rate of 25% of the average earnings during the best 20 years is gradually changed to 20% of lifetime average. The pension accrual rates are determined according to these target replacements, and here we assume accrual under the new scheme.

Further, we have set the age when drawing pensions becomes possible at 60 in order to incorporate various early retirement plans being phased out, while currently the official retirement age is 65 for men and 60 for women. The retirement age for women is being raised gradually so that by 2020 it will be 65 for everyone (SSA 1999). There are different requirements for the length of the working career with contributions to the

public pension scheme for men and women in order to qualify for full benefits, which shows in earlier occurrence of a steep increase in the option value for women in Figure 12. As Figure 12 shows, the incentives to keep working remain almost constant after the retirement age with a noticeable decrease caused by accounting for household work. Including the value of household work into financial incentive calculations with respect to the decision to retire makes retirement more attractive also in the United Kingdom.

7. CONCLUDING REMARKS

The research questions presented in this work are whether there are differences in the lifetime allocation of time between home and the workplace across the eight countries and if the financial incentives to retire differ accordingly. The differences are considered to be caused by the time-geographical authority constraint presented by the social security, tax, and pension systems in each country, and by the welfare regime. Further, the applicability of the welfare regime typology to time use patterns is examined.

There are differences in time use with respect to employment status, gender, and country. The non-employed both spend more time at home and supply more household work than the employed. Women supply more household work than men do, regardless of employment status, but the allocation is more equal among the non-employed. Respectively, men supply more paid work than women do. Thus the female share of total work is close to 0.5 in most countries.

Differences between countries in time use are substantial. Moreover, the time use patterns do no seem to follow the welfare regime typology very closely. For example, some of the countries in the Continental welfare regime exhibit similar time use with respect to paid and household work, but others differ greatly from them, and resemble instead countries in other regimes. However, the measure of dissimilarity does suggest some grouping with respect to location within the core or the periphery of Europe. Thus the time-geographical authority constraints in individual countries seem to work fairly independently of each other despite the ongoing convergence in social in economic factors in play in the European welfare states.

Accounting for the value of household work in the incentive calculations with respect to the decision to retire yields higher net replacement rates and lower option values for retirement. Household work therefore encourages early retirement. The effect of the authority constraint on the incentive to retire is visible first in the different values of household work, measured with the net hourly wage for this kind of work in each country. Second, the tax, social security, and pension systems in each country produce different option value paths for retirement. Their effect can further be reinforced by characteristics of time use patterns. For example, in countries where the increase in the supply of household work after retirement is larger for men than for women, early retirement can be relatively more attractive for men.

The common European concern over the challenges presented by the demographic ageing and the falling labour force participation rates of the ageing to European economies has prompted an effort towards a better understanding of the retirement decision process. The result obtained in this work, that accounting for the value of household in financial incentive calculations makes early retirement more attractive, gives a partial explanation to the low average withdrawal ages from the labour force presented in Table 1.

However, it is clear that people consider other incentives in addition to the financial ones. Individual characteristics, such as the health status and own perception of life expectancy, arguably have a strong effect on the retirement behaviour of the ageing. The effects of health on time use and the financial incentives to retire will be examined in the AGIR project, to which this work also contributes. Linking the kind of descriptive analysis of time use and incentive calculations inclusive of the value of household work to the time-geographical framework illustrates the applicability of time-geographical concepts and methodology in comparative economic geography.

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Appendix 1. The distortionary effect of taxes and social security payments on the value of paid work in the utility function.

The budget constraint inclusive of taxes on capital and wages:

$$Z_w + Z_d = I = T_w w(1 - M_s - M_m - M_k) + T_d w_d$$

where

$T_w w(1 - M_s - M_m - M_k)$ = value of paid work

$T_d w_d$ = value of household work

and

the effect of employer' social security lowering gross wages

$$M_s = \frac{w(1-x)s}{w(1+(1-x)s)} = \frac{(1-x)s}{1+(1-x)s}$$

the effect of wage tax rate

$$M_m = \frac{wm}{w(1+(1-x)s)} = \frac{m}{1+(1-x)s}$$

the effect of consumption tax rate

$$M_k = \frac{w_c k}{w(1+(1-x)s)} = \frac{w_o k/(1+k)}{w(1+(1-x)s)} = \frac{(1-m)k/(1+k)}{1+(1-x)s}$$

where

s = employer's social security tax

w = observed gross wages

m = average wage tax rate

k = average consumption tax rate based on pre-tax price of consumption

Appendix 2. The research partners involved in the Ageing, Health, and Retirement in Europe (AGIR) project.

Centre for Economic Policy Studies (CEPS)
Brussels, Belgium

Centre d'études prospectives et d'informations internationales (CEPII)
Paris, France

Bureau for Economic Policy Analysis, Centraal Planbureau (CPB)
The Hague, The Netherlands

German Institute for Economic Research, Deutsches Institut für Wirtschaftsforschung (DIW)
Berlin, Germany

The Research Institute of the Finnish Economy, Elinkeinoelämän tutkimuslaitos (ETLA)
Helsinki, Finland

Fondación de Estudios de Economia Aplícada (FEDEA)
Madrid, Spain

Federal Planning Bureau (FPB)
Brussels, Belgium

Laboratoire d'Economie et de Gestion des Organisations de Santé Université de Paris-Dauphine (LEGOS)
Paris, France

National Institute of Economic and Social Research (NIESR)
London, the United Kingdom

Appendix 3. The tax treatment of wages in Finland.

Central government and local income taxes and tax allowances, social security contributions, and consumption tax in Finland for the year 2000 (OECD 2002b). Descriptions of tax treatments in other countries are available upon request from the author.

1. Central government income tax

1.1 Standard allowances

- Work-related expenses: deduction equal to 3 percent of wage up to a maximum of FIM 2 400[2]

1.2 Income tax rate schedule

Taxable income (FIM)	Tax on lower limit (FIM)	Tax on wage exceeding the upper limit (%)
47 600 - 63 600	50	5
63 600 - 81 000	850	15
81 000 - 113 000	3 460	19
113 000 - 178 000	9 540	25
178 000 - 315 000	25 790	31
315 000 -	68 260	37.5

2. Local income tax

2.1 Allowances

- Deduction from wage: 20 percent of income exceeding FIM 15 000 up to a maximum of FIM 9 800. The allowance is reduced by 3.5 percent for income exceeding FIM 75 000.

- Basic deduction: FIM 8 800

2.2 Local income tax rate

- Average municipal income tax rate 17.67 percent of gross wage
- Church tax 1.3 percent of gross wage

[2] € 1 = FIM 5.94573

3. Social security contributions

3.1 Employer

- Average employer social security contribution 26 percent of gross wage

3.2 Employee

- Pension insurance: 4.7 percent of gross wage. At age 54, increased by 30 percent.
- Unemployment insurance: 1 percent of gross wage. At age 54, increased by 30 percent.
- Sickness insurance: 1.5 percent of gross wage

Pension and unemployment insurance payments are deductible for income tax purposes

4. Consumption tax

- Standard value added tax rate 22 percent